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BY

THE AUTHOR.

PREFACE TO THE SIXTH EDITION.

The Compend of Surgery has been carefully and thoroughly revised since the publication of the fifth edition by Thos. C. Stellwagen, Jr., and I wish here to express my appreciation of the manner in which he has executed the work.

Many new cuts have been added, some in colors where necessary to assist the text. In all respects the work has been brought down to the requirements of the day.

ORVILLE HORWITZ.

1721 WALNUT STREET, PHILADLEPHIA,
October, 1907.

CONTENTS.

	PAGE.
Inflammation	1
Surgical Fevers	8
Septicæmia and Pyæmia	9
Treatment of Inflammation	12
Suppuration	18
Abscess	19
Surgical Bacteriology	22
Asepsis and Antisepsis	30
Hemorrhage	36
Sutures	40
Wounds (Arteries and Veins)	44
Wounds	48
Hydrophobia	59
Burns and Scalds	61
Ulcers	63
Chilblain	67
Erysipelas	68
Shock or Collapse	70
Tetanus	71
Injuries of the Head	73
Gonorrhœa	83
Orchitis	85
Acute Prostatitis	87
Cystitis	88
Stricture	89
Retention of Urine	95
Hæmorrhage from the Urethra	98
Chancroid	99
Chancroidal Bubo	101
Syphilis	103
Tumors or Morbid Growths	113
Aneurysm	122
Abdominal Surgery	125
Appendicitis	127
Colotomy	130
Intestinal Anastomosis	131
Renal Calculus	133
Nephroptosis or Movable Kidney	133
Nephropexy or Nephrorrhaphy	134
Hernia	135
Inguinal Hernia	138
Congenital Hernia	139

Femoral or Crural Hernia 139
Umbilical Hernia 139
Ventral Hernia 139
Radical Cure of Oblique Inguinal Hernia 143
Dislocations 145
Compound Dislocations 147
Dislocation of Lower Jaw 148
Dislocations of the Clavicle 149
    Humerus 150
Methods of Reduction 151
Dislocations of the Elbow 153
    Wrist 154
    Fingers and Toes 154
    Thumb 155
    Hip Joint 156
    Patella 160
    Knee 160
    Ankle Joint 162
Fractures 163
  of the Upper Jaw 167
    Zygomatic Arch 167
    Nasal Bones 168
    Lower Jaw 168
    Clavicle 169
    Sternum 170
    Ribs 171
    Scapula 171
    Humerus 172
    Forearm 175
    Neck of the Radius 177
    Carpus 178
    Pelvis 178
    Thigh 180
    Femur in Children 185
    Patella 186
    Leg 188
    Foot 190
Treatment of Compound Fractures 190
Sprains 192
Synovitis 193
Coxitis 194
Ankylosis 195
Caries 196
Necrosis 196
Rickets 197
Diseases of the Spine 198
Amputations 200
Excision of Joints 225
When Excision is Admissible 232
Ligation of Arteries 233
    Special Arteries 235

Urinary Calculi 256
Stone in the Bladder 258
Suprapubic Cystotomy 261
Hare-lip 262
Affections of the Nasal Passages 263
Foreign Bodies in Air Passages 265
Affections of the Ear 266
Phimosis and Paraphimosis 267
Hydrocele 270
Hematocele 272
Varicocele 273
Carcinoma of the Testicle 274
Hemorrhoids 274
Fistula in Ano 276
Prolapsus Ani 276
Fissure of the Anus 277
Carcinoma of the Rectum 278
Varicose Veins 278
Club Foot 279
Carbuncle, or Anthrax 282
Boil, or Furuncle 283
Housemaid's Knee 284
Whitlow 284
Drowning 285
Faradization 287
Bandaging 288
Selected Formulæ 320
Index 331

ILLUSTRATIONS.

PAGE.
1. Diapedesis of Leucocytes in Inflammation (Martin) 3
2. Showing Red Cells in Axial Stream and Blood Stasis (Martin) 5
3. Diagrammatic Representation of Abscess Formation (Walshaw) 20
4. Group of Micro-organisms (Williams) 23
5. Mould Fungi, showing mycelium 24
6. Spore Formation 25
7. Pathogenic Yeasts, oidium albicans the cause of thrush (Martin) 26
8. Interrupted Suture 40
9. Twisted Suture 40
10. Glover's or Continuous Suture 41
11. Quill Suture 41
12. Chain Stitch Suture 42
13. Button or Plate Suture 42
14. Mattress Suture 43
15. Lembert's Suture 43
16. Surgeon's Knot 46
17. Reef Knot 46
18. Granny Knot 46
19. Different Methods of Acupressure 47
20. Spanish Windlass, for control of hemorrhage by pressure (Binnie) 48
21. Scarring and Distortion following Burn 62
22. Application of Trephine and Showing Flap (Binnie) 81
23. Urethral Instruments 91
24. Lipoma (Gould) 116
25. Fibroma (Gould) 116
26. Chondroma (Gould) 116
27. Myxoma (Gould) 116
28. Adenoma (Gould) 118
29. Papilloma (Gould) 118
30. Epithelioma (Gould) 118
31. Cylindric Celled or Columnar Celled Epithelioma (Gould) 118
32. Varicose Aneurysm of the Basilic 122
33. Different Methods of Ligature of Aneurysm (Walshaw) 124
34. Incisional Lines for Reaching Certain Abdominal Organs (Walshaw) 127
35. First Stage of Maydl's Operation for Artificial Anus (after Esmarch) 130
36. Second Stage of Maydl's Operation 131
37. Intestinal Anastomosis (Senn) 132
38. Scrotal Hernia 137

39. Femoral Hernia 140
40. Incision and Retractors in Place. Operation for Umbilical Hernia (Mayo after Binnie) 141
41. Line of Incision in Strangulated Hernia 142
42. Operation for Oblique Inguinal Hernia 143
43. Muscles Overlapped and Sutures Placed (Mayo after Binnie) 144
44. Muscles Sutured (Mayo after Binnie) 145
45, 46, 47. Steps in Radical Operation for Inguinal Hernia (Bassim) 146
48. Dislocation of the Mandible 148
49. Dislocation of the Acromial End of the Clavicle 148
50, 51, 52, 53. Figures Showing Various Dislocations of the Head of the Humerus 149
54. Dislocation of the Head of the Humerus Downward 151
55. One Method of Reduction of Dislocation of the Head of the Humerus (dangerous) 152
56. Perpendicular Reduction 153
57. Dislocation of the Ulna Backward 153
58. Reduction of Dislocated Index Finger and Apparatus for Same 155
59. Dislocation on the Dorsum of the Ilium 156
60. Dislocation Backward into the Sciatic Notch 156
61. Dislocation Upward on the Dorsum of the Ilium 157
62. Dislocation Downward into the Thyroid Foramen 157
63. Dislocation Backward into the Sciatic Notch 158
64. Dislocation on the Pubes 158
65, 66. Manipulation for Reduction of Dislocation of the Hip 159
67, 68. Dislocation Forward and Backward of Knee 160
69, 70. Dislocation Inward and Outward of Knee 161
71. Reduction of Dislocation Ankle Joint 162
72. Dressing for Fracture of the Neck of the Humerus 174
73. Fracture of the Radius and Ulna 176
74. Colles's Fracture 177
75. Fracture of Neck of Femur 181
76. Intracapsular Fracture 181
77, 78. Senn's Apparatus for Treating Fracture of the Neck of the Femur 182
79. Extension Apparatus 185
80. N. R. Smith's Anterior Splint 186
81. Dressing for Fracture of the Patella 187
82. Coxalgia 194
83. Pott's Curvature 199
84. Petit's Tourniquet 202
85. Amputation, Circular Method 202
86. Amputation at Hip Joint Showing Position of Pins (Wyeth) 204
87. Amputation at Hip Joint (Wyeth) 205
88. Flap Operation 209
89. Amputation of the Leg 211
90. Long Anterior and Short Posterior Flap 212
91. Syme's Operation 213
92. Incision in Pirogoff's Operation 214
ranc's Operation 215

94. Chopart's Operation 217
95. Amputation of Shoulder Joint 218
96. Circular Amputation 219
97. Teale's Amputation 220
98. Flap Amputation of the Wrist Joint 222
99. Lines of Incision for Resection of Metacarpal Bones (Veau) .. 223
100. Amputation of the Fingers 224
101. Flap for Amputation of Index Finger (Veau) 225
102. Amputation of the Metacarpal Bone of the Thumb 226
103. Finger Amputations (Veau) 227
104. Line of Incision for Amputation of Phalanx of Thumb (Veau) 228
105. Bone Incisions in Finger Amputations (Veau) 228
106. Section of the Bones in Excision of the Elbow Joint (Moullin) 229
107, 108. Excision of Knee Joint 230
109. Ligation of Artery 233
110. The "Stay Knot" of Floss Silk 234
111. Diagram of Triangles of the Neck 236
112. Relations of Common Carotid 238
113. Ligature of Axillary Artery (Moullin) 242
114. Ligature of Brachial Artery (Moullin) 244
115. Ligature of Brachial Artery at the Bend of the Elbow (Moullin) 244
116. Ligature of Radial Artery (Moullin) 245
117. Ligature of the Radial and Ulnar Arteries (Moullin) 246
118. Lines of Incision for Ligation of External and Internal Iliac Arteries 248
119. Ligature of External Iliac and Superficial Femoral Arteries (Moullin) 249
120. Lines of Incision for Ligature of the Superficial Femoral Artery 250
121. Tying the Posterior Tibial Artery 253
122. Lines of Incision for Ligature of the Anterior Tibial Artery .. 255
123. Ligature of Dorsalis Pedis Artery (Moullin) 256
124. Lithotrity 258
125. Lateral Operation 260
126. Suprapubic Lithotomy Incision 261
127. Hair-lip, showing lines of denudation 263
128. Incision of Malgaigue (Binnie) 263
129. Malgaigue Incision (Binnie) 263
130. Application of Bellocq's Canula 264
131. Application of Forceps to Foreskin (Veau) 267
132. Method of Reducing a Paraphimosis 268
133. Incising Constricting Band, Paraphimosis (Veau) 268
134. Incising Mucous Membrane of Foreskin (Veau) 269
135. Removal of Dog Ear Flaps from Mucous Membrane of Foreskin in Circumcision (Veau) 269
136. Graphic Diagram of Different Forms of Hydrocele (Da Costa) 270
137. Tapping Hydrocele of Tunica Vaginalis Testis 271
138. Ischio-rectal Abscess 276
139. Complete Fistula 276
140. Blind Internal Fistula 276
141. Blind External Fistula 276
142. Dilating Sphincter in Fissure of the Anus 277

143, 144. Dr. Allis's Club-foot Apparatus........................ 279
145. Foot Print Outline 280
146. Abdominal and Thoracic Pressure 286
147. Chest Pressure 286
148. Method of Fixing Bandage of Ankle (Davis)............... 288
149. Single Roller (Davis)...................................... 288
150. Double Roller 289
151. Figure of Eight of Ankle.................................. 289
152. Recurrent Bandage of the Head (double roller).............. 290
153. Recurrent Bandage of the Head (single roller) (Heath)...... 291
154. Four-tailed Bandage Applied (Bryant)..................... 291
155. Bandage of One Eye.. 292
156. Knotted Bandage 292
157, 158. Crossed Angle of Jaw (front and rear view) (Davis).... 293
159. Gibson's Bandage (Davis).................................. 294
160. Barton's Bandage (Davis).................................. 294
161. Figure of Eight of Neck and Axilla 295
162. Anterior Bandage of Chest 296
163. Posterior Bandage of Chest 296
164. Suspensory Bandage of One Breast 297
165. Suspensory Bandage of Both Breasts 298
166. Spica Bandage of the Shoulder 298
167. Spica Bandage of the Groin, Retaining Pad 299
168. Spica Bandage of Groin 299
169. Double Spica Bandage of Groins 300
170. Spiral of Toe or Finger 300
171. Spiral of Fingers 302
172. Gauntlet for Hand 302
173. Demi-Gauntlet 303
174. Spica of Thumb 303
175. Spiral Reverse of the Upper Extremity 304
176. Figure of Eight of Ankle 305
177. Spica of Instep 306
178. Spiral Reverse of Lower Extremity 307
179. Square Cap of Head, first step........................... 308
180. Square Cap of Head, completed............................ 308
181. Bis-Axillary Cravat (front) 308
182. Bis-Axillary Cravat (back) 309
183. Cervico-brachial Sling 309
184. Esmarch's Bandage 310
185. Scultetus Bandage 310
186. Velpeau's Bandage 311
187. Desault's Bandage 312
188. Fox's Apparatus for Fracture of Clavicle.................. 312
189, 190. Sayre's Dressing 313
191. Recurrent Bandage for Sling 314
192, 193. Sayre's Plaster Jacket Applied 315
194. Apparatus for Disease of Cervical or Upper Dorsal Spine...... 315
195. Application of Sayre's Plaster Jacket.................... 316

SURGERY.

INFLAMMATION.

Definition.—Is the succession of changes that occur in a living tissue when it is injured, provided the injury is not sufficient to at once destroy its structure and vitality (Burdon Sanderson).

"Inflammation is the series of changes constituting the local manifestation of the attempt at repair of actual or referred injury to a part, or briefly the local attempt at repair of actual or referred injury" (Adami from Da Costa).

Inflammation is a reaction of the tissues to the irritant effect of an injury mechanical, chemical, thermal or bacterial (Sidney Martin).

NATURE OF INFLAMMATION.

When studying the nature of inflammation it is well, for its more ready comprehension, to first note the modifications that occur in the blood vessels and the blood stream. And later, the changes occurring in the perivascular structures.

Active Hyperemia.—Irritation of tissue induces an afflux of blood to the part, following which the blood vessels momentarily contract. If the irritant is removed the phenomena cease. Should irritation, however, persist, the contraction, after exhaustion of the vaso-motor nerves. is succeeded by dilatation of the arterioles, venules and intermediate arteries. At this time there is an increased amount of blood passing into the part which raises the temperature and increases cellular activity, constituting an active hyperemia. In passive hyperemia the increase is due to obstruction or failure of the veins to drain off the excess.

The Capillaries.—It is upon these structures that most of the phenomena of inflammation are carried out. They are minute microscopical tubes about the one-fiftieth of an inch in length and composed of nucleated endothelial cells held together by an albuminoid substance, the membrane of Henle.

The blood is a viscid opaque fluid composed of plasma (liquor sanguinis), and red and white corpuscles; its specific gravity is about 1.054. The red corpuscles are biconcave non-nucleated discs about the $\frac{1}{3500}$ of an inch or 7.5 μ (microns) in diameter; of these, in normal blood, there should be 5,000,000 in a cubic millimeter. They are chiefly concerned in carrying oxygen to the tissues and carbonic acid gas to the lungs, where it is thrown off.

The red corpuscles are of greater specific gravity than the white cells and, consequently, float in the axial or mid-current, while the leucocytes loiter more slowly than the erythrocytes along the mural portion of the stream.

In the healthy state the proportion of erythrocytes to leucocytes is 500 to 1 in favor of the red cells; this proportion varies in disease and during different periods of the day. A meal rich in proteids will cause an increase of leucocytes, known as physiologic or digestion leucocytosis.

The white cells, or leucocytes, are known as ameboid cells or lymph corpuscles. They are globular bodies of about the $\frac{1}{2500}$ of an inch in diameter, possessing a nucleus and power of amœboid movement.

At the seat of an infective process there is first a slight contraction of the capillaries followed very soon by a retardation of the blood flow. During this time the capillaries become greatly distended and there is an exudation of the liquid elements of the blood and, in severer cases, the leucocytes and even the red cells may pass out. This period is succeeded by stagnation of the flow of blood through the capillaries.

It is possibly the extravasation of the liquid elements of the blood and the leucocytes that causes the proliferation of the cells of the inflamed tissue.

The fixed connective tissue cells of the inflamed area and the migrated white blood corpuscles may proliferate; but at least we know that they, with the now coagulated liquid elements of the blood, form a limiting barrier, a wall, that in a large measure serves to prevent the spread of the infecting agent. Infection by some forms of microörganism is much more dangerous, because their products cause rapid solution, and possibly preclude the formation of a limiting wall, in consequence of which, the infective process spreads quickly. The streptococcic infections are notable examples of the latter type.

The leucocytes that are floating quietly along the sides of the vessels in the liquor sanguinis are gradually seen to cling to the vessel wall and begin their passage through it to reach the infecting agent. Just exactly how the leucocytes pass out from the capillaries is a much disputed point that we must allow the pathologist to settle; but suffice it to say they do pass to the infected area, where they begin a battle royal with the infecting organisms.

Exudation of Fluids from the Vessels.—When the circulation is impeded or stopped in the capillaries, there is a greater amount of the liquor sanguinis and white blood corpuscles passing out from the vessels. If the amount of fluid is small it is called a serous inflammation and contains but few white corpuscles. These exudates rarely coagulate and are rapidly absorbed by the lymphatics. Should the inflammatory process persist and be of a decided nature the exudate is richer in leucocytes and possesses a strong tendency to coagulate, which it usually does. The coagulated exudate is very slowly absorbed and imparts to the area a hard-brawny feel that is characteristic of severe inflammation. This same exudate however is nature's barrier to further spread of the infecting organisms.

Diapedesis.—In all inflammations a few white corpuscles pass from the vessels, varying in numbers according to the degree of inflammation. The process of passage of leucocytes from the vessels is known as migration or diapedesis. The leucocytes throw out false foot-like processes that insinuate themselves through the vessel walls and by a flow of their protoplasmic substance gradually invade the perivascular structures. As before stated it has not been thoroughly established as to whether they pass through the stomata or new openings in the wall. The force that attracts the leucocytes to the infected area is known as positive chemotaxis. In some cases they seem to be repelled and when this condition obtains it is spoken of as negative chemotaxis.

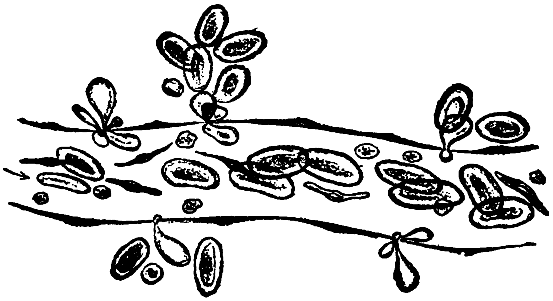

Fig. 1.—Diapedesis of Leucocytes in Inflammation. (*Martin.*)

Changes in the Perivascular Tissues.—In addition to the vascular phenomena of inflammation, the cells of the perivascular connective tissue, be they fusiform, stellate or round, absorb the transuded *liquor sanguinis,* increase in size and multiply; the white blood corpuscles, which have migrated from the vessels, likewise proliferate, and the resulting mass of young cells absorb or eat up the fibrillæ; the connective tissue becomes converted into a mass of small cells, held together by a semi-fluid, intercellular substance, and this small, round-cell infiltrate is called embryonic tissue; in other words, the tissues have reverted to their embryonic condition, thereby constituting the so-called inflammatory lymph. These active changes in the cells are due probably to the stimulating influence exerted upon them by the excess of liquor sanguinis which has escaped from the vessels.

VARIETIES OF INFLAMMATION.

The *nature of the exciting causes* of inflammation, are the specific, as those engendered by animal poison, ferments or contagious principles, such as pyæmia, septicæmia or syphilis; and the traumatic, those resulting from wounds or injuries.

The state of the patient's constitution is to be particularly studied. If he be healthy, there is a tendency to immediate repair; if unhealthy, the tendency to repair is, obviously, more remote; if he be irritable, which is characteristic of most strumous subjects, his condition will be that of nervous exaltation; finally, the patient may be in an infective state, that is secondary to a preëxisting inflammation, and depends on putrefactive changes upon an open surface.

The intensity of morbid action must early be taken into account. It is *latent* when it fails to reveal itself by the ordinary phenomena, as in latent pneumonia, in spinal and other abscesses, and in the ulceration of Peyer's patches accompanying typhoid fever. It is *acute* when it runs its course rapidly and the phenomena are well marked. It is *subacute* when the symptoms are not so well marked as in acute inflammation; and it is *chronic* when the disease is characterized by sluggishness and persistence.

The effusion of inflammation may be *serous, plastic, fibrinous, purulent, sero-fibrinous,* or *sero-purulent.*

TERMINATIONS OF INFLAMMATION.

The terminations of inflammation are, first, to health, by delitescence, when the disease suddenly disappears, before it has passed through its different stages; by resolution, when the disease passes regularly through all the stages of inflammation, the symptoms gradually disappearing, and the parts or organ returning to health; or, again, inflammation may terminate in death by ulceration, which is the molecular death, or in mortification, or gangrene, which is the death of a part on a large scale, or *en masse.*

Extension of Inflammation.—Although inflammation is, primarily, a local process, it often shows a tendency to spread. This may be done in various ways; by continuity of structure, as, for example, in gonorrhœa; by contiguity, as in phlegmonous erysipelas; by the lymphatics, which is, in reality, an extension by continuity; and finally by the blood.

Etiology of Inflammation.—The causes of inflammation are divided into predisposing and exciting.

The more important *predisposing causes* are hereditary tendencies—such as gout, syphilis, scrofula; together with agents that produce debility, as shock, loss of blood, impaired nervous action, bad habits, diabetes, anæmia, plethora, age, sex, temperament, occupation, food, etc.

The exciting causes are: *thermal,* those produced by cold, or heat; *mechanical,* when caused by external injuries, as from a bullet, etc.; *chemical,* when disintegration occurs from the application of corrosive substances, acids, or alkalies; and *parasitic,* the result of microörganisms or their products on the tissue.

THE SYMPTOMS OF INFLAMMATION

Are divided into local and constitutional. They vary with the cause, the seat of the disease, and the constitution of the patient.

Local Symptoms.—1. Discoloration or Redness.—This depends upon hyperæmia and determination or afflux of blood to the part; it is most marked in highly vascular tissues. It is not always a necessary accompaniment of the inflammatory process; it is not well marked in inflammation of muscular or fibrous tissues. There is no discoloration of the brain or nerves, when they are inflamed. In biliary derangement, there is a tendency toward a yellow color. The discoloration is most marked at the focus of the morbid action; it varies in intensity from a slight flush to a deep purple, and it may be circumscribed or diffused.

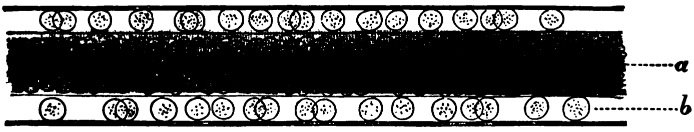

FIG. 2.—Showing Red Cells in Axial Stream and Blood Stasis. (*Martin.*)

Redness is not always a sign of inflammation; to be of value in diagnosing a case, it must be permanent, not transitory, and is to be considered secondarily in connection with the other signs of inflammation.

2. **Heat,** which can be detected by the thermometer, is always present, no matter how deeply situated the disease may be.

It is due to an increased flow of blood, to friction against the walls of the vessels of the part and to cell proliferation, which increases metabolism and so forms heat.

The two symptoms always present in inflammation are heat and disordered function.

3. **Tumefaction or Swelling.**—This is due to capillary engorgement, effusion of *liquor sanguinis* into the perivascular structure, and tissue metamorphosis, or cell proliferation. The amount of swelling varies with the nature of the tissue inflamed; in dense tissue, such as bone and cartilage, there is very little swelling; it is most conspicuous in parts where there is an abundance of lax connective tissue, such as the eyelid and scrotum.

When a serous or synovial membrane is inflamed, the effusions are poured into the cavities that they line.

It may be soft, and pit on pressure, resulting from inflammatory œdema, or it may be hard and brawny when it is due to fibrinous exudation.

This condition may prove beneficial by unloading the blood-vessels, or it may do harm by cutting off the blood supply, or by causing an obstruction, as in œdema of the glottis and stricture of the urethra.

4. **Pain** is usually felt at the seat of the morbid action, but in exceptional cases by reflection it is experienced in parts remote from the disease; hence, it does not always *point out* the situation of the inflammation, as, for example, in psoas abscess, latent pneumonia, coxalgia, and vesical calculus.

Pain sometimes is suddenly relieved in a part; this may be a sign of beginning mortification, unless the relief be due to the influence of opiates or analgesics previously administered.

Pain is more violent when the covering of an organ is affected than when the organ itself is inflamed, as, for example, in pleuritis and peritonitis.

The *causes* of pain are, compression, stretching, irritation, and disorganization of nerves; it is variable in degree. Its character varies: it may be sharp and lancinating, as in inflammation of serous membranes; acute and throbbing, as in formation of pus; dull and heavy, as in periostitis; annoying, as in slight toothache; sickening, as in inflammation of the testes; itching, as in affections of the skin; or burning and scalding, as in gonorrhœa.

In inflammation the suffering comes on gradually, is persistent, aggravated by pressure and muscular contraction, and is usually fixed; there is febrile disturbance, accompanied by redness, heat, swelling and disordered function. The pain of spasm comes on suddenly, is intermittent, relieved by pressure, and is not fixed; there is no fever, and it is not accompanied by redness, heat, or swelling. The pain of neuralgia is paroxysmal and intermittent, is aggravated by pressure, and, like that of spasm, is not fixed, and is unaccompanied by the cardinal symptoms of inflammation.

In very dense tissue the pain is throbbing, which, in a great majority of cases, denotes the formation of pus. Pain is aggravated by the dependent posture of the part.

5. **Functional Disorder.**—In inflammation there is increased sensibility, as, for example, in carbuncle, boil, whitlow, etc.; impairment of special function, as when the eyes, nose, and larynx are affected; increased irritability due to reflex muscular phenomena, as in cystitis, gastritis, dysentery, etc.; and derangement of the secretions, as when the skin, liver, kidneys, etc., are attacked.

Constitutional Symptoms.—In mild cases there is no general constitutional disturbance; but if the inflammation be at all severe, the condition known as fever will ensue. The one sign characteristic of fever is elevation of temperature, and it is an index to the morbid action.

Fever generally manifests itself about twenty-four hours after the local inflammation is established; it is generally ushered in with a chill or what is termed a *rigor*. Although the patient feels cold, if his temperature be taken, it will be found to be above normal. A succession of chills denotes sudden increase of temperature. It continues to rise, and, after a varying interval, the patient feels excessively hot, then a profuse perspiration may break out, the temperature fall more or less, and the rigor is over.

As a rule, the temperature of the rectum and of the vagina is one degree higher than in the axilla. The temperature in the morning should be taken between the hours of 7 and 9 o'clock, and that of the evening between 5 and 7 o'clock.

Another set of symptoms depends on the scantiness of the secretions of the body. The tongue becomes furred and coated, there is great thirst, want of appetite, the bowels are constipated, the urine is less in quantity and high colored, the skin is hot and dry, the respiration and heart's action are increased.

Nervous complications arise; the patient is languid, and complains of severe headache, which may be followed by a confusion of ideas, going on to delirium.

SURGICAL FEVERS (Traumatic).

Fig. 1 represents a graphic division of the different fevers.

- Fevers
  - Benign .....
    - Aseptic, but one form
      - Post-operative rise.
    - Septic...............
      - Surgical fever.
      - Suppurative fever.
  - Malignant.............
    - Sapremia or septic intoxication.
    - Septic infection.
    - Pyæmia.

(1)

Traumatic Fevers.—This form of fever always arises subsequent to injury or follows operations. The simpler forms are unassociated with infection; the malignant types are always reliant upon an infective process.

Aseptic Benign Traumatic Fever.—This form of fever known as the post-operative rise may or may not appear after an operation, a fracture or non-infective injury. There is no premonitory rigor and the patient does not feel sick, excepting from the injury. It usually appears in a few hours after the operation, generally during the evening. It is sometimes delayed until the following day. The temperature rarely mounts above 102° F. and generally stops at about 100° F. In very nervous, high-strung individuals the rise may be as much as 103° F.

The cause of this form of fever is probably the presence of pyrogenous materials in the circulation. As to just what they are or their origin there are many theories.

The fever usually disappears quite or even more rapidly than it appeared, leaving none of the exhaustion associated with the other forms of fever due to infection. The surgeon must be on his guard lest the aseptic form be so rapidly followed by an infective type as to leave no break in the temperature chart. Always examine the wound should the fever persist for a day or so.

Surgical Fever.—This form of fever is the result of the absorption of toxic products formed by the bacteria of fermentation that have infected the wound. They are not the result of pyogenic organisms. Surgical fever usually makes its appearance two or three days after operation and is marked by a chill or chilliness with a rise of temperature. The rise is as a rule sudden, the fever reaching its fastigium in a day or so and presenting quite marked morning remissions with evening exacerbations. The fever usually ranges between 103° and 104° F. The urine is of a febrile character and the symptom complex of fever is present. When the above symptoms present it behooves the surgeon to at once provide free drainage for any retained fluids from the wound area. Should drainage not be instituted pus formation rapidly ensues and the temperature may mount higher. Just so soon as the pus has formed and opens the way for drainage the condition, if properly handled, rapidly subsides and the patient returns to health.

Suppurative Fever.—Given a case of surgical fever where pus has formed and has not had free exit, thereby rendering the absorption of the pyogenic toxins a foregone conclusion and the condition becomes one of suppurative fever. It may be and often is a sequel of surgical fever but often presents at the onset as true suppurative fever. The differential diagnosis is difficult, for the difference between these two forms of fever is largely one of degree. The temperature rises rapidly and is usually preceded by a marked chill. The sufferer is usually very restless with an anxious countenance and all in all seems more sick than is the case in surgical fever. The wound is tense, swollen and of a dusky hue. The area immediate to the incision is the seat of a throbbing pain and may be edematous. The morning and evening temperatures are more extreme and the remission is usually followed by marked sweating.

The surgeon should at once give free vent to all wound products, subsequently asepticizing the area and packing with iodoform gauze.

SEPTICÆMIA AND PYÆMIA.

Septicæmia is an infective disorder which is produced by the absorption of septic microörganisms and their ptomaïnes, generated in an open wound or by inflammation. There are two varieties: septic intoxication and septic infection.

The first variety, sapremia, or septic intoxication is most commonly met with in obstetrical cases where a clot of blood or a portion of the retained placenta becomes putrid; or in operations upon the abdominal cavity; and *occasionally* in large, badly drained wounds.

There being no microörganisms found in the blood, this ailment is supposed to be due to the absorption of chemical poisons, presumed to be ptomaïnes.

The symptoms are those of an alkaloid poison and will vary with the amount of substance absorbed. A severe case will begin with unaccountable restlessness; a rigor or chill sometimes takes place, followed by a marked rise of temperature, nausea, vomiting, diarrhœa, delirium, followed by coma, ending in death. In milder cases there will simply be restlessness and fever, the intensity of the symptoms varying with the amount of poison absorbed.

The treatment of putrid or septic intoxication, septicæmia and pyæmia is identical. These affections depend upon the entrance into the blood of putrid or septic materials, and there must be a point from which this material is derived; hence the wound must be rendered aseptic.

Lay open the abscess, wash it out with antiseptic solutions, and dress it with antiseptic dressings. Give opium to relieve pain if necessary.

The indications are to remove the exciting cause of the disease, by rendering the wound antiseptic, and by keeping up the strength of the patient.

It may be well to begin with a calomel purge, when general indications warrant it. The attention of the surgeon should at once be turned to the necessity of keeping up the strength of his patient, and tonic treatment should be early resorted to. Quinine, with or without iron, should be administered. When suppuration is established Huxham's tincture of bark and aromatic sulphuric acid are the remedies, and sleep must be procured by opiates. Brandy or whisky, port or sherry wine, beef tea, milk, eggs, and such articles as will keep up the strength of the patient, are early indicated. Alcoholic drinks, pushed to slight intoxication, are chiefly to be relied upon.

Cleanliness must be insisted upon, and great good will be attained by diligent and unfailing attention to the dressings.

The position of the part should be so arranged as to favor the escape of the secretions, the wound kept freely drained.

Should hemorrhage exist, muriated tincture of iron is a remedy to be resorted to; it should be given in doses of 20 to 30 drops, every four hours. Ergot or atropia, combined with the iron or given separately, will be found valuable in allaying the copious sweating that is apt to exist in this disease. The most reliable remedy is believed to be camphoric acid which should be used with great caution.

Internally the main dependence is to be placed on whisky or brandy, hence free stimulation should be resorted to. Quinine, iron, strychnine, and anodynes if required, should be employed. Vomiting is best controlled by very hot water, or a four per cent. solution of cocaine in five-drop doses. If the stomach is irritated by decomposing or foul material, gastric lavage will often control the vomiting.

The second variety, or septic infection, is due to absorption of the ptomaïnes and the bacilli and ~~micrococci in the~~ blood, and their proliferation.

This variety usually makes its appearance about the third or fourth day after the injury; it begins with a chill, followed by a continued fever of the typhoid type. There is a perceptible increase of temperature in the evening with profuse and exhaustive sweats, accompanied by vomiting and diarrhœa; the stools are dark, tarry, and offensive. The skin is hot and dry or clammy. The tongue is covered with a thick, dry, brown coat; the urine is scanty and high colored; toward the close delirium and coma supervene, when the case terminates in death. On examination after death the blood is found to be liquid and dark, with extravasation into the serous membranes; there is frequently cloudy swelling of the liver and kidney, with marked enlargement of the lymphatics and spleen.

Treatment.—Every effort should be made to secure an antiseptic condition of the wound. The internal treatment is the same as that laid down in the first variety.

PYÆMIA.

Pyæmia differs from Septicæmia in this respect, that the absorption and dissemination of the poison give rise not only to a general disease, but also cause the formation of secondary foci of inflammation—the so-called *metastatic abscesses;* that is to say, pyæmia is septicæmia combined with the formation of abscesses. The abscesses are called secondary, because they are ~~secondary~~ to a primary infection. They are called embolic, because they originate from emboli. They vary in size from a seed to a large walnut; they are generally found in the lungs, liver, spleen, kidneys, and brain, and are usually upon the surface of organs.

The symptoms of pyæmia present themselves within the first ~~week~~ **after putrid** or septic changes have begun in an infected part; they are ushered in by a severe rigor, followed by profuse sweating. The temperature will vary from 103° to 105°. The skin is dry, tongue coated, attended by sordes on the gums and teeth; the countenance may become jaundiced; there will be nausea, diarrhœa, and all the symptoms of asthenic fever. There will be dull, heavy pain in the part where the abscess is forming. If the abscess is forming in any of the external tissues of the body, it will be known by fluctuation.

Prognosis.—Serious; usually fatal. Repeated shivering is the very worst omen. A temperature of or above 106° is very unfavorable.

TREATMENT OF INFLAMMATION.

The indications for the treatment of inflammation are: the removal of the exciting cause and the re-establishment of the equilibrium of the circulation.

As long as the exciting cause remains, the inflammation will continue; after its removal, the disease generally terminates spontaneously.

To establish resolution the treatment is divided into general, local, and constitutional.

The General Treatment, which is adapted to all stages of inflammation, is rest, elevation, and relaxation of the affected part. Local rest may be procured by bandages, splints, adhesive straps, or weights; the efforts of the patient to avoid the pain of motion will act as a splint. Elevation of the affected part acts as a restorative of the equilibrium of the circulation by retarding the ingress of arterial blood in undue quantity and expediting the return of venous blood and lymph.

To obtain relaxation, the affected part must be placed in such a position as to relax all the tissues in the immediate neighborhood.

Local Treatment.—The division of inflammation into stages is quite rational, hence remedies that do good in one stage may do harm in another (Da Costa).

The first stage is that of engorgement or of increased intravascular pressure, with commencing effusion; to lessen stasis, restore the tonicity of vessels, and relieve the perivascular tissue of effused material, local bleeding is sometimes resorted to. By this means the flow of blood through the inflamed part is accelerated, thus washing out, so to speak, the adherent white corpuscles and breaking up the rouleaux formation of the red corpuscles, as well as relieving in part the surrounding tissues of the excess of liquor sanguinis and white cells, due to inflammatory extravasation, by the operation of the well-known law of capillary attraction. The materials that caused the engorgement having been removed, the capillaries may again resume their normal condition.

Local depletion may be done by Punctures, Scarification, Leeching, or Cupping.

Puncturation may be employed when there is great tension, as in tonsillitis, hemorrhoids, etc.

Scarifications; incisions varying in length, are resorted to in inflammation produced by infiltration of urine, phimosis and paraphimosis, etc.

Leeches are usefully applied to the neighborhood of inflamed parts, but should not be put on the inflamed surface itself. They should be placed between the inflamed part and the heart. If it is desired to remove a leech after a certain time, this may be accomplished by sprinkling salt upon it. The bleeding may be stopped by applying to the part nitrate of silver, muriated tincture of iron, spider's web, the actual cautery, styptic cotton, adrenaline chloride, pressure, hot water and human blood. The flow of blood from a leech-bite may be continued by the application of warm water and leech extract.

The supply of blood to an affected part may be cut off by ligation of the artery leading to the seat of disease; by compression, either by tourniquet or with the fingers; by flexion, as by flexing the forearm on the arm.

The application of *cold* is frequently of service and it may be used either wet or dry, either spring water or ice water may be used. A cooling lotion, consisting of alcohol one part and water one part, or saltpetre (nitrate of potassium) five parts, chloride of ammonium five parts, and water sixteen parts, is recommended, care being taken that the temperature is not kept below 45° F. The cold lotions may be contained in ice bags, the siphon or Esmarch's cooling coil.

The effect of cold applications is very powerful in the treatment of inflammation; it restores the tonicity of the capillaries by contracting their calibre, thus retarding effusion into the surrounding structures; it reduces the temperature; it arrests tissue metamorphosis and promotes diffusion of the effused materials into the vessels; it relieves tension and pain by restoring the equilibrium of the vessels.

The application of cold is contraindicated in asthenic types of fever, in old persons, in young children; where there is great exudation and diseased blood vessels it may cause gangrene. When stasis has occurred cold is extremely dangerous. Nancrede has pointed out that cold should never be used intermittently because of the reaction that occurs followed by dilatation and increased hyperemia. Recent studies on the effect of cold are somewhat contradictory, hence it should only be used where the case is to be carefully watched. In inflammations where it is essential that the leucocytes be attracted, such as appendicitis and other allied abdominal conditions, the use of the bag has been discarded by some surgeons. Always bear in mind that abdominal rigidity may be caused or intensified by the ice bag.

When the second stage or that of plastic effusion is fully established, compression should be employed by means of a muslin or elastic roller bandage, adhesive strips, compressed sterile sponge, or bags of shot. These act by supporting blood-vessels, restoring their tonicity, and facilitating the absorption of effused material.

Acetate of lead is applicable to all cases of external inflammation; it acts as an astringent, sedative, and sorbefacient; it is usually employed in the strength of eight grains of the salt to one ounce of water.

Chloride of ammonium is used in the same strength as the acetate of lead. Tincture of iodine is employed in the same manner as the salt of lead; it is especially beneficial in œdematous and periosteal inflammations. It should be applied directly over the seat of morbid action; it is usually diluted about one-half with alcohol.

Nitrate of silver, varying in strength from two grains in an ounce of water to the application of the solid stick, depending upon the purpose for which it is employed, is a remedy frequently resorted to.

The cold or hot douche is beneficial in stimulating the absorbents; it is especially applicable in sprained ankle.

Massage is efficacious in getting rid of extra-articular adhesions.

The stage of threatening or fully-established suppuration may be called the third stage; the indication is to favor the formation of pus.

The symptoms of the advent of the third stage are generally a chill or a creeping sensation. The tension of the part, with throbbing pain and increased swelling, are augmented. These are to be met by the application of heat and moisture, by means of hot fomentations, stupes, continuous warm baths, and by antiseptic poultices.

Counter-irritants are particularly desirable in cases of subacute and chronic inflammations; they act by causing an afflux of blood to points of application, thereby reducing flow to the inflamed part beneath.

There are three classes of counter-irritants, viz.: rubefacients, vesicants, and suppurants.

The *rubefacients* are: mustard plasters, turpentine stupes, tincture of iodine, ammonia liniment and capsicum.

The *vesicants* are employed to produce superficial inflammation and vesication. They are cantharides, collodion cum cantharide; equal parts of powdered carbonate of ammonia and lard; lint saturated with chloroform applied to the part and covered with oiled silk.

Suppurants are agents used to produce suppuration; they are croton oil, issues, setons, tartar emetic ointment, and the actual cautery.

Constitutional Treatment.—General bloodletting is to be used when the inflammation is characterized by high vascular pressure, in strong, robust individuals. Bloodletting is likewise indicated in inflammation of any of the great viscera or their coverings; especially is this the case in acute cerebral congestion. To be of use it must be resorted to in the first stage of inflammation.

Bloodletting is contraindicated during epidemics, in typhoid conditions, gangrenous, ulcerative, or suppurative processes, erysipelas, in corpulent persons, in extremes of age, in drunkards, and in nervous individuals.

The effects of general bloodletting are to relieve arterial tension, diminish the volume, accelerate the current of the blood, relieve the tissues of effused material, and reduce the temperature by withdrawing a large amount of pyrogenous or fever-producing material from the general circulation. It likewise promotes the action of other remedies. The wet cup and the withdrawal of blood as in bloodletting are rarely resorted to in this day. It would seem that in many cases the physician and surgeon are biased by the belief that such a course is obsolete; when in reality it would be the very best procedure.

When these desirable effects are produced, the condition may be maintained by the use of arterial sedatives, such as tincture of veratrum viride, aconite root, gelsemium and tartar emetic.

The *diaphoretics* in general use are acetate of ammonium, citrate of potassium, Dover's powder, fluid extract of jaborandi, muriate of pilocarpine, lemon juice with bicarbonate of potassium.

The *diuretics* in use are infusion of digitalis, salts of potassium, citrate of caffein, colchicum, cocaine, coffee, etc.

Cathartics are used to evacuate the bowels, deplete the mucous membrane, excite the action of the liver, salivary glands, and mucous follicles, and to stimulate the absorbents, thereby inducing them to remove inflammatory deposits.

Enemata of warm water, or soap and water, are frequently employed, to which turpentine or vinegar may be added. Glycerine suppositories may be used to unload the bowels, to take the place of cathartics.

Emetics are indicated when the skin is hot and dry, the tongue heavily coated, and when there exists a sense of great weight at the epigastrium. All emetics should be followed by copious draughts of luke-warm water. The emetics generally used are alum in doses of a drachm, sulphate of zinc in scruple doses, sulphate of copper in like quantity, mustard and salt, ipecacuanha in scruple doses, tartar emetic in two-grain doses. Emetics should not be prescribed in inflammation of the brain, eye, or of the viscera below the diaphragm. Should emetics be deemed advisable it is better to wash the stomach with normal salt solution introduced and withdrawn by the stomach tube.

Mercury is indicated when the pulse is soft, skin relaxed and moist, and when there is a general tendency to restoration of the secretions, and not before. It reduces the plasticity of the blood and causes absorption of the embryonic tissue. It is of great benefit in membranous croup, hepatization of the lungs, iritis, syphilitic inflammation, and such like diseases. It is usual to combine with the mercury a small quantity of opium, to prevent its being too rapidly carried off by the bowels.

It is contraindicated in persons of strumous habit; the old, ill-fed, badly nourished, and the anæmic.

Mercurialism is evidenced by a peculiar fetor of the breath, red and tumid gums, metallic taste in the mouth, an increased flow of saliva, ulceration of the buccal mucous membrane, and diarrhœa. *The treatment* for this is astringent gargles; Goulard's extract, one ounce to water eight ounces, used every hour or two; alum, tannic acid, copper, zinc, atropia by hypodermic injection, chlorate of potassium in doses of 20 to 30 grains three times daily, morphia, p. r. n. and syrup of the iodide of iron.

Anodynes.—*Opium* is applicable to the treatment of inflammation in all stages of the disease.

The exhibition of opiates should be preceded by bloodletting when admissible; in other cases by a cathartic. The remedy should be administered in full doses, as small doses act as stimulants, while larger doses act as sedatives.

Hypnotics.—When the patient is restless but not suffering acute pain, hypnotics are indicated, such as phenacetin, gr. v, bromide of potassium, gr. xxx, chloral, gr. x, taken at bedtime, paraldehyde in doses of one drachm freely diluted, or hydrobromate of hyoscine in doses of $\frac{1}{120}$ of a grain, may be used; if the patient suffers great pain, one-sixth of a grain of any of the salts of morphia may be added. Sometimes a glass of milk punch, ale, or whisky will answer.

Tonics.—The principal are quinine, iron, and nux vomica, or its equivalent, strychnia.

Antipyretics.—These are principally quinine, given in twenty-grain doses, administered about an hour before the evening exacerbation; salicin in doses of about fifteen grains during the intervals, antifebrin or antipyrin administered by the stomach or hypodermatically.

Antiphlogistic Regimen.—In the early stages of inflammation, the patient has no desire for food, nor should he be induced to eat, as it may produce a feeling of great distress, as well as nausea. At this period iced lemon juice without sugar is very grateful. After the administration of a cathartic, a liquid diet should be resorted to. Suitable articles are beef tea, milk, soups with the fat skimmed off, Valentine's meat juice, koumiss, raw oysters, sweetbreads, soft-boiled eggs, eggnog, etc. A patient on a liquid diet should have at least two pints of milk with one pint of beef tea during twenty-four hours. Stimulation by brandy, whisky, sherry, Madeira wine, etc., must be resorted to when necessary.

Nutritive Enemata.—When the patient is unable to bear diet by the stomach, then rectal injections of nutritious substances must be resorted to. A nutrient enema should not exceed three ounces. The following articles may be used: milk, eggs, or milk and eggs combined, and beef tea. The injection should be repeated about every three hours. To each injection should be added five grains of pepsin and five grains of pancreatin, together with ten drops of dilute hydrochloric acid and one drop of carbolic acid. When milk is used, the hydrochloric acid should be omitted.

Good ventilation is absolutely necessary. The temperature of the sick apartment should range from 68° F. to 70° F.

Cleanliness and *Quietude* should be strictly enforced.

PATHOLOGICAL TERMINATIONS OF INFLAMMATION.

Pathologically inflammation terminates in one of three ways: By the effusion of serum, by the effusion of lymph, and by the formation of pus. They are all results of inflammation and perform an active part in the inflammatory process. Serum is the changed liquor sanguinis of the blood, the pabulum upon which the proliferating cells subsist.

Effusion of serum denotes a mild type of inflammation. The structures in which it is most generally present are loose connective tissues and serous cavities; large quantities are sometimes poured out by the mucous membranes of the alimentary canal, as in diarrhœa and cholera. When the effusion accumulates in parts endowed with abundant connective tissue, there will be œdema. If the effusion is into a joint or serous cavity there will be dropsy, or general œdema.

In œdema the parts present a soft, glazed, inelastic swelling which pits on pressure. Dropsy in cavities is detected by palpation and percussion.

Treatment of the Terminations of Inflammation.—*Local.*—By tapping when in a cavity; by multiple punctures when in connective tissue; by incisions when gangrene is threatened; by compression to promote absorption; by sorbefacients, the principal of which are iodine, acetate of lead, chloride of ammonium, nitrate of silver, hot and cold douche, and massage. The *constitutional treatment* is by hydragogue cathartics, diuretics, and mercurials.

Deposit of Lymph denotes a higher grade of inflammation than effusion of serum. There are two varieties, plastic and aplastic. The plastic lymph is the formative variety, and is capable of being organized; on the contrary, aplastic lymph cannot be organized and is nonformative. This variety of lymph forms the linings of sinuses and fistulas, and prevents their healing.

A deposit of lymph disappears by absorption, atrophy, pus formation, fatty degeneration, and calcification. Should it remain, it will be as a permanent thickening; or it may be employed to repair the structures damaged by inflammation.

The local treatment is the same as that for effusion of serum; the constitutional treatment will require the exhibition of alteratives and tonics, such as iodide of potassium, bichloride of mercury, iodide of iron, etc.

SUPPURATION.

Suppuration is the formation of pus in a part. It is most commonly found in the connective tissue, serous and mucous membranes, and in the lungs.

Pus is a fluid of new formation, made up of serum, albumin, pyrine, fatty matter, and certain salts; its solid constituents are corpuscles, shreds of connective tissue, and granules of fatty matter. The microscope reveals the presence of germs, upon which suppuration depends. Fibrin is never found in pus because the micrococci of suppuration feed upon the fibrinogen and prevent the formation of fibrin; hence pus does not coagulate.

Pus effects a good purpose when facilitating the loosening and extrusion of foreign substances and in assisting granulation; the good effects, however, are more than counterbalanced by the bad; when there is considerable destruction of tissue and exhaustion of the patient.

The varieties of pus are: 1. Healthy or laudable pus, which is an

" opaque, homogeneous, yellowish fluid, of an alkaline reaction, mawkish odor, sweetish taste, and of a specific gravity of about 1.021 to 1.040." 2. Sanious, or ichorous pus, which is a product of unhealthy inflammation; it is thin, highly acrid, and of a reddish color. 3. Fibrinous pus is semi-fluid, of a whitish or ash color, with flakes of fibrin; it is found in inflammation of the joints. 4. Gummy pus; highly gelatinous, met with in tertiary syphilis. 5. Muco-pus, *i. e.,* pus mixed with mucus. 6. Contagious pus; the variety met with in smallpox, gonorrhœa, and in venereal ulcers.

Pus is usually formed in from twenty-four to seventy-two hours, but the time will vary much with the constitution of the patient and the structure of the part in which the inflammation is seated. It always works its way along the course of least resistance.

When pus is formed under fascia, or deep in the mamma or pelvis, and cannot make its way to the surface, the constitutional symptoms are much more severe.

Symptoms.—The formation of pus is often attended with severe constitutional irritation; there are rigors succeeded by heat, and if the inflammation be extensive or seated in any vital organ, the constitutional disturbance will be very severe, and the shivering, which indicates the formation, will also be marked and followed by a powerful reaction. When the pus is easily produced, there may be little or no rigor; as upon a mucous membrane.

ABSCESS.

An abscess is a circumscribed cavity of new formation containing pus.

Abscesses are known as superficial, deep-seated, acute, or phlegmonous, chronic, common, specific, and residual.

An acute abscess is one that runs its course rapidly, and is always accompanied by well-marked inflammatory symptoms. It is, from its great frequency, one of the most important of surgical diseases. When an inflamed part becomes more heated and more swollen; when the skin assumes a dusky hue, and appears glossy and shiny; when the pain, which has been of a dull, heavy nature, becomes persistent, steady, and throbbing, and when the skin over the swelling is œdematous, and fluctuation is appreciable then there can be no doubt that an abscess has formed.

Pathology.—In the formation of an abscess the first phenomena are those of inflammation, that have already been described; when the production of embryonic tissue has been reached, if it stops at that point resolution is established and recovery ensues; but should the new "cellular infiltrate" be invaded by the microörganisms of suppuration, and a suitable soil for their growth be found, they will be nourished by the albumin in the tissues; and it is their excreta, known as ptomaïnes, that peptonize the fibrin and change the embryonic tissue to a liquid, known as pus.

The changes here described begin in the lymph spaces, so that an abscess rarely has its commencement at a single focus; the accumulation of liquid and cells causes the distention of the lymph spaces. The fibrous tissues separating these spaces are widely pressed asunder, causing their supply of blood to be cut off, sloughing being the result; moreover, the living pus cells find in these fibres a source of nourishment, and they are thus destroyed; hence the lymph spaces become converted into a single cavity, an abscess.

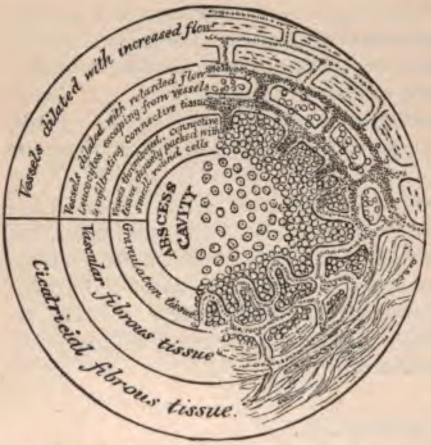
Vessels dilated with increased flow
Vessels dilated with retarded flow
Leucocytes escaping from vessels
& infiltrating connective tissue
Vessels thrombosed, connective
tissue densely packed with
small round cells
ABSCESS
CAVITY
Granulation tissue
Vascular fibrous tissue
Cicatricial fibrous tissue.

FIG. 3.—Diagrammatic Representation of Abscess Formation.

From the periphery to the centre of an abscess all stages of inflammation are presented, from the first, which is the stage of congestion, to the last, which is the period of the formation of pus.

Between these two conditions, there is a middle point where the inflammatory process has reached only the formation of embryonic tissue, and hence it is that the cavity of an abscess is always circumscribed by a tissue of new formation, which may vary much in thickness.

Not only does an abscess extend in various directions, but all abscesses tend to empty themselves at the point of least resistance; they mostly approach the surface, where they spontaneously evacuate themselves, their tendency being toward the skin. The abscess discharges through a small opening or fistula that is due to the death of a limited portion of the overlying tissue and skin.

The contents of an acute or phlegmonous abscess are pus, micrococci, and some little shreds of dead tissue. In some cases the abscesses contain gas, when the contents are extremely fetid.

A phlegmonous abscess occurs in all periods of life, in all classes of persons; it varies in size; is most frequently met with in subcutaneous connective tissue, in the muscular tissue, around the lymphatic glands, and around the bones. Its most common sites in the viscera are the liver and brain.

Tuberculous Abscess.—*Cold Abscess, Strumous Abscess,* or *Chronic Abscess.*

The effect of the bacillus of tuberculosis on tissue is to produce a chronic inflammation which results in the production of granulation tissue; this is the so-called pyogenic membrane of old authors, and acts as a protective wall to the surrounding tissue.

The degenerative changes that take place are caused by local anæmia and by the chemical action of the ptomaïnes of the tubercle bacilli; they consist of a caseation and liquefaction of the inflammatory products.

If the bacillus meet with sufficient resistance in the surrounding tissue, it exhausts the nutritive material in the granulations and dies; or it remains in a latent condition; the granulation is converted into a cicatricial tissue, and the local lesion is cured. This is designated spontaneous cure. The liquid may also be absorbed when a similar favorable termination is possible. If the cavity is opened under antiseptic precautions, cure is accelerated; if, however, secondary infection with pus microbes takes place, the patient is in danger of septic infection, as well as local and general dissemination of the tubercular process. See *Psoas and Lumbar Abscess.*

Treatment of Suppuration.—Remove, if possible, the morbid condition of the constitution upon which the disease depends; gentle purgatives may be useful, and exciting causes, such as thorns, splinters, etc., should be removed.

The **treatment of an acute abscess** consists in the early evacuation of the pus. The incision must be made before the pus has an opportunity to open into parts which should be spared, and it must be made at the point from which the best drainage can be procured.

All abscesses must be treated with antiseptic precautions, because microörganisms are in the tissues circumscribing the abscess; following the directions given in the article under the head of Antiseptic Surgery.

The *tubercular abscess* must not be allowed to open itself spontaneously. This precaution is to be particularly borne in mind when the glands of the neck are affected.

rranged in packets.
organisms.
curved rods spirally arranged.

robiosis).—Aërobic organisms require free oxygen life cycles.

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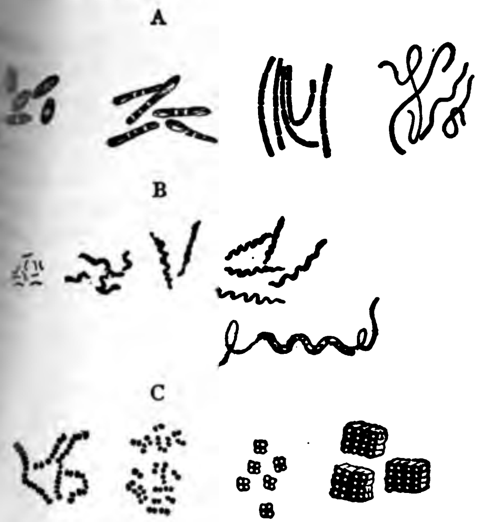

; 2, Bacilli; 3, Spirillæ. *C*, 1, Staphylococci; 2, Strepto- cocci; 4, Tetracocci; 5, Packet Forms. (*Williams.*)

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Open the abscess in the most dependent portions, using a straight, sharp bistoury for the purpose; evacuate the accumulated material; scrape out the abscess thoroughly; wash it with an antiseptic solution of bichloride of mercury, then bring the opening together by means of a suture; insert drainage, and place iodoform gauze upon the outside.

Constitutional Treatment.—Where the suppuration is profuse, tonics, such as iron, quinine, strychnia, together with good, nutritious diet, milk punch, etc., with change of air and climate, must be insisted upon.

SURGICAL BACTERIOLOGY.

Bacteriology.—The science concerned with the study of bacteria (Gould). Bacteria or microörganisms are generally believed to be of vegetal origin and closely allied to the algæ or sea weeds.

Definition.—Bacteria are minute unicellular organisms supposedly of vegetal origin and devoid of the green coloring matter of plants (chlorophyll).

The classification of bacteria under several heads as follows:

1. Shape (morphology).
2. Relation to air (oxygen).
3. Viability or non-viability of supportive media.
4. Relation to disease.

Morphology	1. Small spheres (micrococci). 2. Rods, straight or curved (bacilli). 3. Twisted rods (spirillæ).
Relation to air..............	1. Aërobic. 2. Anaërobic. 3. Facultative aërobes or anaërobes.
Viability or non-viability of supportive media............	1. Parasites. 2. Saprophytes.
Relation to disease.............	1. Pathogenic. 2. Non-pathogenic.

The micrococci are divided according to their arrangement as follows:

Diplococci—grouped in pairs.

Staphylococci—resembling a bunch of grapes.

Streptococci—arranged in chains.

Tetrads, Sarcinæ—arranged in packets.

Bacilli are rod-shaped organisms.

Spirillæ, a series of curved rods spirally arranged.

Relation to Air (Aërobiosis).—Aërobic organisms require free oxygen in order to fulfill their life cycles.

Anaërobic.—Those that thrive best in an atmosphere devoid or deficient in free oxygen; of these two divisions there are obligatory aërobes and anaërobes, or those living only in the presence or absence of air. Again there are certain of them that possess the dual ability of growing either with or without oxygen or air, and they are termed facultative aërobes or anaërobes.

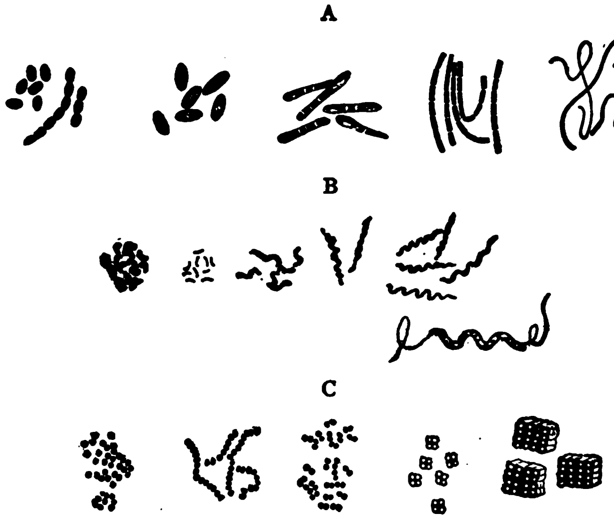

FIG. 4.—*A*, 1, Yeasts; 2, Bacilli; 3, Spirillæ. *C*, 1, Staphylococci; 2, Streptococci; 3, Diplococci; 4, Tetracocci; 5, Packet Forms. (*Williams.*)

Probably the most important classification to the surgeon is that of pathogenic and non-pathogenic. The plus or minus pathogenicity of an organism depends largely upon their recent habitat. It is an established fact that germs by selective inoculation may be made more or less virulent, according as to how they have grown, viz., having been nurtured upon living animals or artificial culture media.

Microörganisms differ greatly and many possess characteristics by which they are known. Some are highly mobile, as the bacillus coli communis and its congener, the bacillus typhosus. Others are non-motile, as the bacillus anthracis and tetanus. Their movements are produced by small protoplasmic outgrowths termed flagellæ.

To study bacteria we must consider many points; a few of the more important are as follows: Habitat, size, gas producing, tinctorial reaction, arrangement, pathogenicity, cultural characteristics, aerobiosis, optimum temperature, thermal death point, and methods of reproduction.

By a summation of the different characteristics of plants they are classified, and, likewise by studying these microscopic plants throughout their life cycles, as suggested above, we familiarize ourselves with them, and are able to differentiate many varieties.

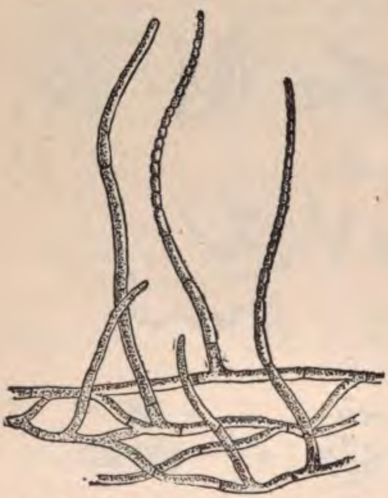

FIG. 5.—Mould Fungi, showing mycelium.

The most important micro-organisms to the surgeon belong to one of the three following groups:

1. Yeasts, Saccharomycetes or Blastomycetes.

2. Moulds, thread fungi or Hyphomycetes.

3. Bacteria, fission fungi or Schizomycetes.

The yeasts produce alcoholic fermentation of saccharine or carbohydrate substances and are usually responsible for the fermentation of beer, wines and liquors. In their process of breaking up the carbohydrates they eliminate carbon dioxide gas and so cause the raising of bread. They are much used in the arts and sciences. They consist of single or multiple large round or oval cells that reproduce themselves by gemmation or budding. A few of them are pathogenic to man and animals, notably the oidium albicans, the cause of thrush—a disease affecting the mucous membranes of certain parts, generally the mouth.

Moulds or hyphomycetes are long thread-like organisms, apparently consisting of a number of short threads connected together and forming a long one.

The schizomycetes are the most important group, for it is through them that most infective diseases arise. They comprise all those organisms that multiply by fission, including practically all the micrococci and bacilli.

REPRODUCTION.

Reproduction of bacteria occurs by one of two methods—by fission or by spore formation. When the organism is about to divide by fission, if it be a bacillus, it enlarges slightly and later develops a constriction at its center that eventually cleaves it into two. The coccus flattens and somewhat resembles a short rounded coccal bacillus, later developing the constriction and splitting into two.

Spores are highly refractive round or oval bodies found in certain bacteria. Bacilli and spirillæ multiply by spore formation. Some organisms multiply by both methods.

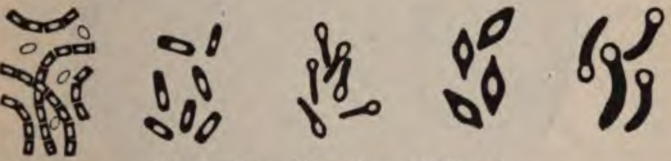

Fig. 6.—Spore Formation. (*Williams.*)

Spores are of endogenous or arthrogenous origin. Endogenous spores arise, especially in bacilli. The cellular substance becomes granular and cloudy. The granules unite and form a highly refractive spot called the spore. The remainder of the organism disappears or remains as a shrivelled envelope.

Arthrogenous spores are generally believed to be cocci that have swollen and become highly refractive and resistant to unfavorable surroundings. Spores play an important part in the production and continuance of disease. They are usually formed when conditions are unfavorable to growth. They are very difficult to destroy and in many instances will lie dormant like the seeds of plants, which in fact they are, until favorable times, whence they mature and so produce disease. This fact makes necessary the systematic sterilization of all materials and instruments used in surgery.

Staining.—Most organisms when examined are colorless, although certain of them produce color (chromogenic), and in some instances the color produced plays an important part in the name of the germ (staphylococcus pyogenes aureus). In order to study them microscopically and in the tissues they are usually stained. This is accomplished by means of one of the aniline dyes. The stain is generally applied in either an alcoholic or watery solution about 2 per cent. in strength.

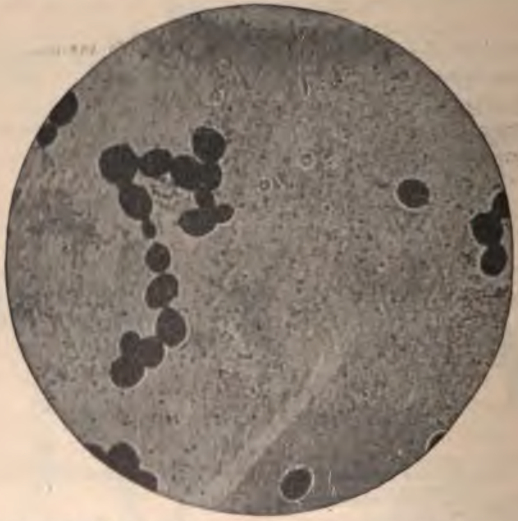

FIG. 7.—Pathogenic Yeasts, oidium albicans the cause of thrush. (*Martin.*)

Watery solutions possess greater penetration and are more commonly used.

CULTIVATION.

This is carried out upon two primary forms of culture media, the natural and artificial. These are divided into solid and liquid media of each class. By the peculiarities of growth, of gas production and by liquefaction of certain forms of media we have a valuable adjunct in bacteriological research.

BACTERIOLOGY.

HABITAT.

They are very widely distributed throughout the soil, the water, and the air. They exist in all surface and ground waters in varying numbers, but are very few or almost lacking in artesian well waters. They inhabit the soil to the depth of about 1 meter. They are quite common in the air excepting at sea, at great heights or in desert regions, where they are much fewer in number. Most of the dangerous organisms, such as pus producers and those associated with the more important infections, do not circulate very freely in the air. They generally remain attached to some stationary object and unless stirred up do not infect the air. This was for a number of years of great importance to the teaching surgeon and at one time was responsible for the obnoxious carbolic acid spray and other appliances devised to sterilize the air. This became so engrossing a question that the German surgeons seriously considered the inadvisability of operating before large bodies of students. Scientific research and practical application have to-day eliminated these bete noirs. The air of a room in which a number of persons are confined is more sterile than before their entrance, provided they do not stir up dust, because each pair of lungs acts as a filter.

Koch's Circuit.—To establish the pathogenic relation of a germ to a disease it must complete what is known as Koch's circuit. It must first be always found in the diseased person or animal. It must be grown in pure culture outside of the body; these cultures must be capable of reproducing the disease. From the inoculated animal the germ must be grown in pure culture.

PATHOGENICITY.

Most diseases of an infective origin are directly referable to a causative organism. Modern bacteriological investigation leads us to believe that each separate disease has its own particular germ or group of germs that cause it. This existing relation between cause and effect is termed pathogenicity.

It does not necessarily follow that when a germ has gained access to the body it will induce disease for the personal equation and inherent vital resistant powers of the individual combat its influence. The germ may form spores that will resist the efforts of nature to destroy them and remain quiescent until nature removes the check. They may then mature and multiply, producing disease. This change may be induced by a general lowering of vitality or by a bruise or other local injury producing a locus minoris resistentiæ.

ENTRANCE OF GERMS INTO THE BODY.

They may enter through the various mucous membranes; a cut or break in the continuity of a surface; through the sweat glands and pores, and finally, according to some, may be transmitted through the placenta from the mother to the fœtus, as in the case of the poison of syphilis and smallpox. Many, however, believe that the syncytium is impervious to microörganisms despite this evidence.

INTOXICATION AND INFECTION.

Intoxication is that condition where the germs remain localized and their secretions known as toxins are absorbed and cause a chain of symptoms termed intoxication.

If the germ enters the blood stream the condition is then termed general infection. The term infection, however, is used to denote the presence of an organism in a wound not necessarily implying the entrance into the blood.

Sapræmia is intoxication induced by the toxin of a pyogenic organism. Should this germ enter the circulation the condition then becomes septicæmia.

PRODUCTS OF BACTERIA.

They manufacture certain products that have the power of liquefying cells; these substances are but indefinitely understood and by some have been termed enzymes. They are not true enzymes because they belong to the class of organized ferments. Their action is very similar to the enzymes of the saliva and other alimentary juices. The bacterial secretions are supposed to be the means by which the organisms destroy tissue; and when absorbed are probably responsible for many of the phenomena of disease.

Toxalbumins.—"Any of the poisonous albuminoids that are produced or separated from the albumin of the tissues by the agency of bacteria and entering the circulation constitute the cause of the general symptoms of infectious diseases" (Gould).

Toxalbumins are formed during the growth of many organisms, notably those of tetanus, typhoid fever and cholera. In tetanus it is the tetano-toxin that is absorbed and produces the systemic effects of the disease since the organism remains localized in its original area of infection. The same may be said of the bacillus of Eberth. The action of these toxalbumins very closely resembles the action of certain of the physiologic products of digestion such as albumoses and peptones. When peptones are injected into the blood stream of a dog they are capable of producing rapid death.

Bacteria do not contain chlorophyll, hence they rely upon formed organic materials for their sustenance which they decompose, and thus the wasting and destruction of tissue following infection.

PTOMAINS.

When saprophytic organisms cause putrefaction of organic matter there are certain substances formed called ptomains. Physiologically they resemble certain alkaloids and therefore have been termed cadaveric alkaloids. They are capable of producing severe illness and death. Canned meats, ice cream, milk, cream puffs, stale fish and crustaceans are apt to contain them.

The more common ones are tyrotoxicon, found in ice cream, milk and cheese; typhotoxin in old beef broth cultures of Eberth's bacillus; morrhuin in cod-liver oil; muridin and murin in decomposing flesh and muscarin in toad stools and rotten fish.

LEUCOMAINS.

Leucomains are the substances described by Gautier as emanating from the physiologic metabolism of nitrogenous substances in the body. They are classified as the uric acid and kreatinin groups.

When retained within the organism these substances produce the condition known as auto-intoxication, hence the necessity of keeping the emunctories active after surgical procedures.

IMMUNITY.

By immunity is understood the innate power of the body to neutralize or destroy the infecting medium or its toxalbumins and so protect itself from disease. This power may be congenital (natural) or acquired—congenital or natural as presented by the negro race in their comparative freedom from yellow fever and in certain children born of syphilitic parents who cannot contract this disease.

"Acquired immunity may be active or that possessed by an individual after recovery from certain infectious diseases" (Gould); passive that conferred by the introduction of antitoxins or vaccines.

ALEXINS AND ANTITOXINS.

Alexins are germicidal substances furnished chiefly by the white cells and held in solution by the alkaline liquor sanguinis of the blood.

Antitoxins are substances formed in the bodies of animals either naturally or in consequence of inoculation with some pathogenic bacteria that neutralize the toxic products of these organisms. It is through the combined action of alexins and antitoxins that immunity is produced. There have been many theories put forth in explanation of immunity, notably among the more recent that of Ehrlich to which the student is referred in the text-books.

ASEPSIS AND ANTISEPSIS.

Directions for the Preparation of Surgeon, his Assistants and Attendants. Rules for the Preparation of the Room and Instruments, Necessary Material to be used during a Surgical Operation.

Aseptic surgery is the method where heat or chemical antiseptics, or both, are used for the purpose of obtaining absolute surgical cleanliness; after this has been accomplished only such solutions, dressings, etc., are used as have been sterilized and made germ-free by heat.

This form of operative surgery can only be successfully carried out where an "operation of deliberation" is contemplated, and where the operator has the time and means to prepare the patient, his assistants, and all the paraphernalia needed during the operation; as when the abdominal cavity is to be opened.

In the **antiseptic** method the same antiseptics are used for procuring cleanliness, and in addition, chemical solutions, and dressings impregnated with them, are used during and after the operations.

The following are the general directions to be observed: Before undertaking an operation of any moment, the surgeon should see that the room to be occupied by the patient is properly prepared; with this object in view every article not absolutely needed should be removed; the carpets should be taken up; the floor and walls scrubbed and then washed with bichloride solution (1:1000); curtains should be taken down; upholstered sofas and chairs replaced by those made of wood alone, etc., etc.

The day before an operation is to be undertaken the parts should be shaved, washed with soap and water, then with ether or alcohol, and finally with sublimate solution 1:1000, or if necessary 1:500.

A sublimate gauze dressing must then be applied, and retained in place by bandages, where it is to remain till the operation is about to be performed.

Especial care must be taken to thoroughly clean the genitals, armpits, navel, etc. When operations are to be performed on the head the entire scalp should be shaved, and in brain cases the eyebrow must be removed. Patients who are begrimed by dirt, oil or grease should have the parts first well rubbed with sweet oil and then washed with soap and water, or Johnson's Ethereal Soap.

To prevent the patient from touching the part to be operated upon the arms and legs should be wrapped in bichloride or sterilized sheets or towels, during and for some time prior to the commencement of the operation.

The principal antiseptics in surgical use are bichloride of mercury, biniodide of mercury, hydronaphthol, peroxide of hydrogen, formaldehyde, carbolic acid, alcohol, chlorine, and boric acid. Carbolic acid is used in solutions of 1 : 20 to 1 : 40, and bichloride of mercury internally in solution in 1 : 5000 for the irrigation of joints; 1 : 10,000 for the peritoneal cavity, and externally in from 1 : 1000 to 1 : 4000.

In the peritoneal cavity distilled water or normal salt solution is used.

Before the operation begins the hands and forearms of every one who is to come in contact with the case must be thoroughly washed with hot water and soap, and scrubbed with the nail brush for six minutes; then scrubbed in 1 :1000 solution of bichloride of mercury. The surgeon should be in his shirt sleeves, with the sleeves pinned well up above the elbow. He and his assistants should wear white gowns, or should be protected by a carefully prepared sheet so folded as to be about five or six feet long, and at least two feet wide.

Should the operator sweat he should tie a towel around the forehead and head, so as to absorb all the fluid. Especially should this precaution be taken if the abdominal cavity be the seat of operation. It is also advisable to wear a small skull cap over the hair. To wipe the hands, when necessary, a sterilized towel must be used. The nurse should wear white muslin, or some other wash goods.

The chief source of infection, during an operation, are the hands of the surgeon and his assistants, instruments not properly disinfected, sponges and dressings.

During the washing the nails must be thoroughly cleaned by scraping with penknife or nail cleaner. The nail brush should be always kept in 1 :40 carbolic solution or in 1 :1000 sublimate solution.

Whenever the hands or forearms touch any object which has not been disinfected they should be immediately again washed in bichloride solution.

The usual methods of disinfecting the hands are as follows: Mechanical cleansing is a most important procedure, and when we speak of the surgical hand we consider that it extends to the elbow. The hands should be scrubbed for from five to six minutes with a moderately stiff brush. The surgeon must be accurate as to the length of time the scrubbing is carried out. For this purpose the ordinary hour glass, egg-timer, is very useful.

The soap used should be one of the liquid varieties and preferably Johnson's ethereal soap. The ether in this preparation greatly facilitates cleansing by dissolving the fatty secretion of the skin and so disengaging dead or loose epithelial scales and germs.

In scrubbing it is essential that the strokes of the brush be parallel with the creases and folds of the skin. The surfaces between the fingers should also receive the proper attention. The nurses and assistants should be carefully instructed in the preparation of their hands.

Succeeding the mechanical cleansing antiseptic materials are used according to specially devised methods, the more practical of which are as follows:

The Weir-Stimson Method.—Thorough mechanical cleansing having been properly done, about one tablespoonful of fresh chlorinated lime is placed in the palm of the hand and to this is added an equal amount of fresh crystalline washing soda, the two are then rubbed in the hands to a thick creamy paste by the addition of sterile water; and the paste rubbed well into the skin of the hands and forearms up to and including the elbow. Care should be taken to carry the material well under the finger nails and surrounding cuticle; this is best accomplished by sterile orange wood sticks. The hands and arms are thoroughly rinsed in sterile water and immersed in a solution of bichloride of mercury 1:1000; this may be followed by washing in alcohol to remove the bichloride. This method, when properly carried out, gives excellent results, it having for several years been regularly tested in the clinic of Professor W. W. Keen.

The Welch-Kelly Method consists, after proper mechanical cleansing, in immersing the hands and forearms in a warm saturated solution of potassium permanganate in sterile water for two minutes. They are then immersed in a warm saturated solution of oxalic acid until the potassium permanganate is decolorized. Then wash off the oxalic acid in sterile water and reimmerse for two minutes in a solution of bichloride of mercury 1:500; wash again in sterile water and dry upon sterile towel.

Furbringer advises, after mechanical cleansing, to scrub the hands and arms in 15 per cent. alcohol for three to five minutes to remove all soap and epithelium. He then scrubs well, using a solution of 1:500

corrosive sublimate, the alcohol facilitating the penetration of the mercurial solution.

Rubber Gloves.—These should be used as a protection to the patient and the surgeon in certain classes of cases. (1) Where the surgeon's hands, of necessity, must come in contact with infective matter. (2) In operations upon joints or where the peritoneal cavity or brain is to be opened. (3) Where the surgeon is compelled by emergency to operate shortly after having handled pus or virulently infected cases. They are further of use in military and all forms of emergency surgery. Gloves after using should be thoroughly scrubbed both inside and out, rinsed in sterile water and then in bichloride. Following this they should be boiled for fifteen to twenty minutes, dried upon a sterile towel, dusted inside with sterile talcum powder and wrapped in a sterile towel. Cotton and fiber gloves should not be used since they are not reliable.

Instruments are best sterilized by boiling in a suitable sterilizer for fifteen to twenty minutes; a small amount of sodium carbonate, 1 per cent., added to the water prevents rusting. Knives and all delicate appliances should be protected by cotton.

Rubber and silk urethral instruments are best boiled in salt solution, always taking the precaution to employ an open vessel, that allows the steam to pass off. Instruments with rubber or wood handles are to be soaked in 5 per cent. solutions of carbolic acid or 2 per cent. solutions of formaldehyde; this method does not insure surgical cleanliness. All surgical instruments should be made with metal handles, free from grooves, letters and knurls. After boiling they may be placed in shallow enameled pans and covered by sterile towels or water or 5 per cent. carbolic acid solution.

After using, the instruments should be thoroughly scrubbed and polished and stored in dust-proof instrument cabinets or trays. All complicated appliances should be rinsed in alcohol to remove water, and if necessary have their parts oiled with sterile liquid vaseline to prevent rusting.

Sterilization of ligature and suture materials is best done when possible by heat or a combination of heat and chemicals. Silver wire, silk, horse hair, silk-worm gut and linen or flax thread should be wound loosely upon glass spools and boiled for thirty minutes, then stored in recently boiled alcohol. Silk and linen thread should not be boiled in soda solutions with instruments.

Animal Ligatures.—For preparation of these there have been many methods devised, but we shall only speak of the more practical.

Catgut is prepared by scraping away the muscular and mucous coats, leaving only the submucous; this is then cut into strips and twisted. The gut should be obtained from perfectly healthy animals. Many surgeons hesitate to use it because in the process of twisting many germs may be incorporated with it. Surgical gut should be rough and yellow, not white.

The gut should be soaked in ether for twenty-four hours to remove fat, then loosely wrapped upon glass spools and boiled in alcohol under pressure for one-half hour. The spools are kept in the alcohol until needed. A still better method is to tie the gut into skeins of proper length; wrap each in a small piece of gauze; dry in a hot air sterilizer at 80° C. for three hours; place each in a vessel containing cumol (a fluid hydrocarbon), making sure that the gut does not touch the sides of the vessel, lest it burn; it is then boiled for one hour over a sand-bath (boiling point cumol 165–170° C.). The skeins are then removed with sterilized tweezers and the cumol driven off by dry heat in sterilizer at about 80° C. The ligatures can be stored in sterilized glass tubes whose ends are hermetically sealed by melting the tip. A file mark greatly facilitates fracture of the tube.

The formalin method is useful and readily carried out. The gut is wound on sterilized tubes or rods. These are placed for twenty-four to forty-eight hours in a 2 to 4 per cent. aqueous solution of formalin. They are then thoroughly washed in running water for twelve hours to rid them of formalin. It is next boiled in water for fifteen minutes and cut into strands that are stored in the following mixture: 950 parts absolute alcohol, 50 parts glycerine, 100 parts pulverized iodoform. Senn advises frequent shaking to keep the iodoform in suspension. The ligatures may be treated with chromic acid to prevent too rapid disappearance in the tissues. It is rarely necessary for the surgeon to prepare his own ligature material for the manufacturers offer a very reliable product hermetically sealed and ready for use.

Mops of sterilized gauze or antiseptic gauze are now generally used instead of sponges, which have been practically abandoned by many surgeons. The abdominal gauze pads devised by Professor Ashton are usually about eight or ten inches square. They are made of a number of folds of the ordinary gauze, loosely hemmed, then sterilized or made antiseptic by sublimate solution.

Dressings must be prepared and laid on clean bichloride or sterile towels before commencing an operation.

During the operation the parts should be frequently irrigated with salt solution.

One of the most important features of antiseptic surgery is drainage. Upon this question there is a great diversity of opinion. Should it be deemed necessary to drain there are several ways of accomplishing it. Drainage is obtained by rubber tubes, horse hair, silk-worm gut, catgut, glass tubes, rubber tissue and gauze. Drainage tubes are prepared in convenient lengths and sterilized by boiling. Gauze and catgut constitute capillary drains; they will not drain pus.

Drainage should be used in infected wounds and where there is reason to believe there may be capillary oozing or an outpouring of serum after operation. It lessens the danger of fever by carrying off wound fluids and so preventing their absorption by the system. After the tube is removed the drainage is carried on by capillary attraction. The stitches may be taken away by the seventh or eighth day. Catgut is employed to drain serum; its ends must be kept moist, to insure drainage. The rubber tube must be perforated with holes at the distance of a quarter of an inch; the ends pared off close to the surface, and kept in place by a stitch or pin.

The usual indications for changing dressings before the wound heals, are—when rubber drainage tubes need to be removed; when secondary hemorrhage occurs; when, the operation not having been done antiseptically, there is evidence of increased temperature; when plastic operations and other supplementary work are to be done.

Should it become necessary to remove the dressings, it must be done with disinfected hands; the new dressing being carefully prepared, using bichloride or sterilized towels.

Iodoform is used only on suppurating or putrid wounds, or in tuberculous cases.

If on the day following the operation the patient's temperature should rise to 102° F., accompanied by a full and hard pulse, a saline cathartic should be administered, and in addition, tincture of aconite in doses of three drops every three hours may be given, until the pulse changes; if the temperature reach 102° F., on the second day after an operation, it would be advisable to change the dressing and examine the wound.

Tissue which is likely to slough should be trimmed away before closing the wound. All bleeding from the small vessels should be effectually attended to before closing the wound, and all clots must be removed.

Previous to commencing an operation the following must be made ready:

A rubber sheet, one of the most necessary articles, must be six feet long; it must be wetted with the bichloride solution, and is to be placed under the patient and so arranged that fluids will run into the pail below; wet bichloride towels may be substituted for the rubber sheet.

The irrigator, filled with normal salt solution. A large dish filled with 1:1000 bichloride solution for washing. A dist filled with 1:30 carbolic acid solution or sterile water for instruments.

A wide-mouthed bottle containing No. 8 and No. 7 catgut in alcohol; a bottle of chromic catgut.

Sterile gauze; bichloride gauze; wood wool or jute; bichloride cotton for dressings.

A skein of catgut in a saucer of 1:1000 bichloride solution; bichloride-gauze bandages.

Razor; nail-brush; prepared sponges; alcohol and bandages; one hand-basin; one basin for sponges; one basin for 1:1000 bichloride solution; one basin for dressings; one basin for sterile towels; one small basin for alcohol; one bowl for ligatures; one bucket to receive discharges; one syringe; pins; pitcher for hot distilled water; pitcher for cold distilled water.

For modes of preparing the various antiseptic solutions, see formulæ at the end of the volume.

HEMORRHAGE.

Hemorrhage is either arterial, venous or capillary.

Arterial hemorrhage is known by its bright crimson or vermilion tint, and by its issuing from the divided vessels in jets, synchronously with the contraction of the left ventricle.

In *venous hemorrhage* the blood is of a dark-blue tint, and flows from the divided vessel in a continuous stream.

In *capillary hemorrhage* the blood is of a reddish tint, and exudes from the tissues; in other words, there is a welling up.

Subcutaneous hemorrhage, also called diffused aneurysm, exists where there is no external flow of blood, either from want of parallelism of the wound in the vessel and the open wound in the tissue, or from the rupture of a vessel by a blow, or otherwise, subcutaneously.

Effects of Hemorrhage.—When a large vessel is divided, or a large number of small ones, death may take place at once. Usually the patient is seized with syncope, after the wound has been bleeding for some time, when the heart's action becomes more depressed, and, the blood becoming more coagulated, nature is given an opportunity to form a clot within and around the artery. After a time reaction takes place, here is danger of a recurrence of the bleeding, and of the from exhaustion.

Treatment of the Effects of Primary Hemorrhage.—Put the finger over each divided extremity of the vessel, or apply a provisional tourniquet; place the patient in the recumbent posture, with the head lower than the body. Compress both axillary arteries and both femorals, so as to divert the flow of blood to the brain. The application of roller bandages to the extremities is a good practice. Apply external heat, by means of bottles of hot water, warm blankets, etc., etc.

Stimulate the heart's action by a hypodermic of atropia, gr. $\frac{1}{100}$, or a hypodermic of digitalis or ether. As soon as reaction takes place, resort to means to effect a permanent arrest of hemorrhage.

The reaction which follows upon a copious loss of blood is *generally attended by hemorrhagic fever*, the pulse being frequent, soft, and jerky; heart fluttering and tremulous; eyes suffused; skin hot and dry; countenance flushed; headache, nausea, and possibly vomiting, accompanied by wandering of the mind. The proper treatment for this condition is rest, exclusion of light, and give intravenous infusion or hypodermoclysis of normal salt solution; apply ice-bags to the head; sponge the surface with an evaporating lotion, administer beef extract, koumiss, brandy, milk in small quantities and at regular intervals. See Formulæ 54 and 57.

When there is collapse from the loss of blood, a saline injection (hypodermoclysis), one drachm of common salt to a pint of water, introduced under the skin in the region of the outside of the thigh, or the buttock, by means of an aspirator, has frequently saved life. Intravenous infusion of normal saline solution is often of the greatest use in shock from hemorrhage. It is also used in suppression of urine, diabetic coma and sepsis. It is well to prepare beforehand for an emergency in desperate cases and have ready the necessary instruments. There should be prepared by sterilization a scalpel, an aneurysm needle, thumb forceps, scissors curved on the flat, an Allis dry dissector, and catgut and silk-worm ligatures. The nurse should have sterilized a large glass funnel with three or four feet of rubber tubing attached and which contains at its distal end a blunt aspirating needle. Some employ an Aveling's syringe, or the instrument devised by Dr. Geo. W. Spencer, of the Jefferson Hospital. These are useful but not necessary.

Normal salt solution consists of sterile water containing 0.6 per cent. of sodium chloride. This can be readily prepared by sterilizing a heaping teaspoonful of a fine grade of common salt and wrapping in several folds of sterile paper for storage. The contents of the paper are added to one quart of sterile water at a temperature of 110° F., and thoroughly dissolved. The formula of Locke and Hare is more scientific and comes conveniently prepared for use. The fluid should be carefully watched and never allowed to fall below 105° F. From one-half to two pints are slowly injected into a superficial vein. Adrenalin chloride may be added to the solution in extreme cases.

To perform the operation tie a fillet above the elbow, this makes the veins below prominent; select one of sufficient size (usually the median basilic or basilic), ligate the vein and incise above the ligature; insert the blunt aspirating needle and tie in place by a ligature. Then remove the fillet and allow solution to pass slowly into blood stream. The nurse should see that all air was excluded from tube and cannula, and keep funnel constantly filled. Don't permit fluid to enter too rapidly, should occupy about ten minutes.

When the hemorrhage takes place in a cavity, in consequence of the bleeding from one of the abdominal viscera or from the lungs, the patient should be given, every four hours, either three grains of gallic acid or two grains of acetate of lead, with one grain each of powdered digitalis and ergotine, together with half a grain of opium.

These remedies sustain the action of the heart, produce contraction of the blood-vessels, and render the blood more plastic; hence, they are of great utility when the blood-vessel cannot be reached.

Reactionary or Recurrent Hemorrhage comes on during reaction from operation or injury and within the first forty-eight hours, usually about twelve hours after. It is generally due to a faulty application of the ligature, including a nerve in the ligature, by the application of Esmarch's bandage, or to the reaction which takes place after a shock. It is often due to failure to ligate small vessels that did not bleed at time of operation; thus great care should be exercised to properly ligate and control all bleeding points before closing the wound.

The proper treatment is to elevate the stump and compress the main artery; if hemorrhage continues, open the wound, turn out the clots, wash with warm saline solution and apply hot wet pads to flaps; these control capillary oozing but stimulate smaller vessels to bleed so that they may be found and controlled. If there be much oozing, elevate the part, and then apply broad compresses.

Secondary Hemorrhage comes on after twenty-four hours from the time of the operation, but more generally about the time of the separation of the ligature. The mode of procedure is to remove the dressings; if there be merely oozing, proceed as directed in Reactionary Hemorrhage, but if the dressings are saturated with blood, the parts swollen and painful, and there are other evidences of profuse loss of blood, re-open the wound, turn out the clots, search for the bleeding vessels and ligate them.

Secondary hemorrhage may take place at the time of the separation of the ligature, and it generally comes from the distal end of the artery. This should be frustrated by compression; but if the hemorrhage continues or recurs, it is proper to cut down upon the artery and ligate it.

Secondary hemorrhage may occur from *sloughing* or *ulceration* of an artery, or from imperfect closure of an artery when a ligature separates, either through a diseased state of the artery or of the constitution. In this case it is necessary to cut down upon and secure the bleeding orifice; if this cannot be done, carefully graduated pressure and styptics may be tried. A small button of lint, saturated with adrenalin chloride, may be put into the bleeding point, over which large compresses are placed and firm pressure applied. The bleeding surface may be touched with a hot iron raised to a "black heat," which will sometimes be more efficacious than any other styptic. Should these measures fail, the artery must be tied above the point of hemorrhage, and, finally, amputation may be necessary.

When there is bleeding from arteries the following rules are to be observed:—

Should there be bleeding from an open wound, cut down, and tie the artery at the site of the wound, no matter what its condition; if the artery be brittle, resort to acupressure, or the knot of Balance and Edmonds.

If an artery has been wounded, and there is no bleeding when the surgeon first sees the case, it should be let alone, because hemorrhage may not recur; but a provisional tourniquet should be placed over the situation of the main trunk, so that it may be tightened should the slightest appearance of blood make it necessary. The exceptions to this rule are when a patient is to be transported some distance, when the patient is a hard-drinking man, when the vessel lies directly in the wound, so that it can be seen; in these cases the wounded artery should be secured at once.

If the artery be partially or wholly divided, cast a ligature around each end.

In applying a ligature, if a branch is given off near the wounded artery, include it in the grasp of the ligature, or secure it separately.

If the branch of a main artery is wounded near the trunk, treat it as though it were a wound of the main trunk.

On cutting down on a divided artery, if the distal end be so far retracted that it cannot be found, tie the cardiac end, and place plugs of iodoform gauze in the wounded or distal side, keeping it in place by successive layers of gauze and a bandage from the distal extremity of the limb to the site of the wound.

SUTURES.

Sutures are made of catgut, silk, wire, silk-worm gut, kangaroo tail tendon, horse hair, and linen thread.

The sutures ordinarily in use are: 1. The *Interrupted.* 2. The *Twisted.* 3. The *Glover's or Continuous* Suture. 4. The *Quill* Suture. 5. *Buried* Suture. 6. *Chain Stitch* Suture. 7. *Subcuticular* Suture. 8. *Mattress or Quilt* Suture, *Continuous Mattress Suture.* 9. *Button or Plate* Suture. 10. *Shotted* Suture. 11. *Intestinal* Sutures—(*a*) *Lembert's,* (*b*) *Halsted's,* (*c*) *Purse String,* (*d*) *Czerny* Suture.

There are numerous modifications of the above sutures.

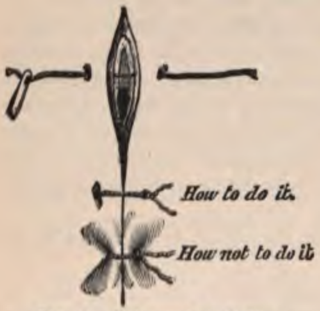

FIG. 8.—Interrupted Suture.

1. The Interrupted Suture.—The needle, carrying a single ligature, is passed through the skin on one side of the wound from *without inward,* and is then inserted from *within outward* at the corresponding point on the opposite side of the wound. The ends of the ligature are drawn together and tied tightly in a double knot. The ligature is then cut and another suture introduced at an interval of half an inch, and so on.

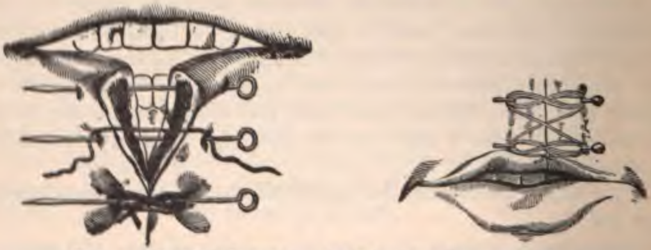

FIG. 9.—Twisted Suture. *A,* first step; *B,* second step.

Lembert's Interrupted Suture is recommended in wounds of the intestines. The stitches should be three-eighths of an inch from the margin of the wound, the middle suture being first introduced; the distance between the sutures should not exceed a quarter of an inch. When the requisite number have been applied the ends are to be tied, and cut off close to the knot. The bowel is then restored to the abdominal cavity.

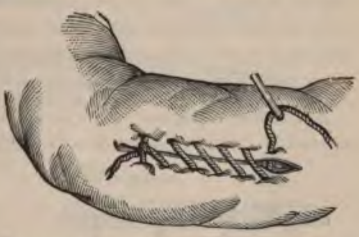

FIG. 10.—Glover's or Continuous Suture.

2. The Twisted or Harelip Suture.—Having placed the edges of the wound accurately in contact, a sufficient number of needles are passed through the edges of the wound. When the necessary number of needles have been introduced and the parts accurately adjusted, the middle of the long ligature is twisted around the uppermost needle in the form of a figure ∞. Then the two ends of the ligature are brought down and twisted around the other needles successively, when they are secured by a knot. After insertion the points of the needles must be cut off with pliers. The upper pin must be removed at the end of the second day, and the lower pin at the end of the third day.

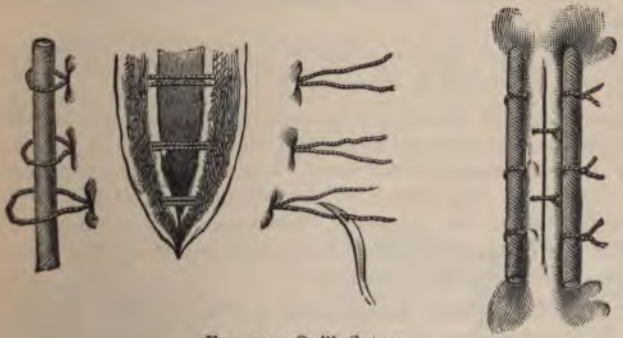

FIG. 11.—Quill Suture.

3. The Glover's or Continuous Suture.—This suture is employed in wounds of the intestines and abdomen. It is applicable to cases of injury of great extent when there is tendency to the escape of fecal matter in the intervals between the stitches. It is merely the ordinary stitch employed for sewing materials together; it is made by simply passing the needles diagonally from one side of the wound to the other.

4. **The Quill Suture.**—In inserting this suture a needle armed with a double thread is passed through the tissues as in applying the interrupted suture. The loops on one side of the wound margin are laced over a quill or some substitute such as a roll of gauze and the double end tied over a similar object on the opposite side. This suture makes even tension on the wound.

5. **Buried Sutures.**—In wounds involving muscles and tendons it is advisable to insert interrupted sutures to secure quick union and obliteration of dead spaces. For this purpose we may use catgut, kangaroo tendon, silver wire, etc.

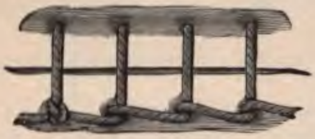

FIG. 12.—Chain Stitch Suture.

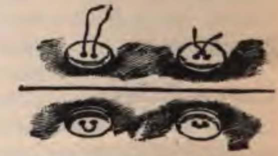

FIG. 13.—Button of Plate Suture.

6. **Chain Stitch Suture.**—This is really a continuous suture with each stitch interlocked as shown in Fig. 12.

7. **Subcuticular Suture.**—This suture was introduced by Halsted. The needle is inserted at one pole of the wound and so passed as to loop through the subcuticular tissue. It is brought out just beneath the cut edge. It is then entered in the reverse direction on the opposite sides and brought out as before. This suture is useful upon the face and it also prevents in large measure infection of stitches (producing stitch abscesses) by skin cocci.

8. **Mattress or Quilt Suture** (Fig. 14).—The diagram explains this suture. It is used to relieve tension and may be applied either interrupted or continuously. The continuous mattress suture is sometimes called Cushing suture.

9. **Button or Plate Suture.**—This suture is inserted similarly to the quilled suture excepting that its ends are threaded over buttons or perforated lead plates. Small rolls of gauze may be used in lieu of buttons.

10. **Shotted Suture.**—This suture is applied in several ways and the ends secured by passing a perforated lead shot over them and squeezing it so as to clamp them. It is applicable in harelip, cleft palate operations, rectal and vaginal operations where the knotted ends might cause irritation.

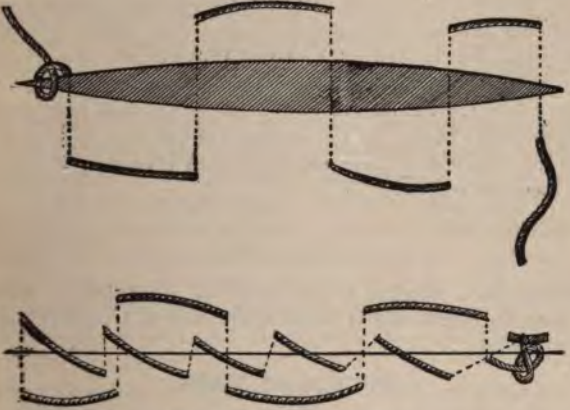

FIG. 14.—Mattress Suture.

11. **Intestinal Sutures.**—(*a*) *Lembert's Interrupted Suture* is recommended in wounds of the intestines. The stitches should be three-eighths of an inch from the margin of the wound, the middle suture being first introduced; the distance between the sutures should not exceed a quarter of an inch. When the requisite number have been applied, the ends are to be tied, and cut off close to the knot. The bowel is then restored to the abdominal cavity.

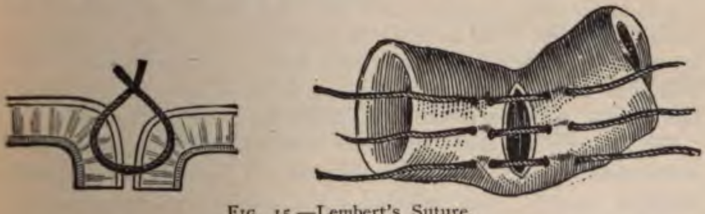

FIG. 15.—Lembert's Suture.

(*b*) *Halsted's Mattress or Quilt Suture.*—A modification of Lembert's suture similar to the mattress suture before described.

(*c*) *Purse String Suture.*—This suture is inserted at a little distance from the margin of the part to be invaginated. The needle is passed as in the Lembert suture. The free ends are drawn together and tied, closing or pursing the gut.

(*d*) *Czerny Suture.*—The needle is inserted through the serous membrane of the intestine on one side of the wound and passes down into and partially through the submucous coat. It does not pierce the mucous coat but is carried outward through the submucous and emerges at the cut margin of the wound. Upon the opposite side it is entered into the cut margin in the submucous coat and brought up through the outer coats. By this method the two raw margins of bowel can be approximated. These sutures should always be reinforced by several Lembert sutures.

WOUNDS.

A Wound is a solution of continuity, or separation of continuous parts, suddenly occasioned by external violence, and generally attended with hemorrhage.

WOUNDS OF VEINS.

Hemorrhage from wounded veins is not, as a rule, dangerous, unless from a large and deep-seated trunk in which valves are not present, or from a large varicose vein of the leg. The bleeding in ordinary cases may be restrained by pressure and elevation; it may, in rare cases, be necessary to apply a ligature.

WOUNDS OF THE ARTERIES.

Arteries consist of three coats: first, the internal coat, which is a serous membrane, made up of an elastic longitudinal layer, interspersed with connective tissue corpuscles and lined by endothelial cells; secondly, the middle or muscular coat, made up of muscular and elastic fibers; and, thirdly, a fibrous coat, consisting of fibrous tissue.

The sheath of the artery is derived from the deep fascia of the parts surrounding it; on the sheath ramify nervous filaments and the vasa-vasorum.

The wounds of arteries may be incised, lacerated or punctured.

Lacerated arteries, when torn across, contract almost immediately, and bleed but little. The most approved method is to apply ligatures; otherwise, when reaction takes place and the power of circulation is restored, hemorrhage will ensue.

Punctured wounds are followed by a tumor, bearing the characters and requiring the treatment of aneurysm.

Contused wounds, such as are produced by severe bruises or by gunshot wounds, sometimes destroy the vitality of a portion of the artery, and are frequently followed by sloughing and fatal hemorrhage. In these cases the patient should be kept at rest until the sloughing process is completed. A precautionary tourniquet should be placed around the limb, and the patient instructed in its use in case hemorrhage should ensue.

If an artery of small size be cut across, there will be brisk hemorrhage for a time, but it will soon cease; the divided artery contracts and the vessel retracts within its sheath, and there is coagulation of the blood upon the face of the wound, sufficient to temporarily arrest the bleeding. Then the column of blood *inside* the vessel coagulates, and, lastly, there is exudation of the fibrin around and between the cut edges, which seals up the opening permanently by becoming organized.

The coagulum within gradually becomes firmer, adheres to the walls of the vessel, loses its color, and forms, with the impervious end of the artery, a fibrous cord.

If a *very large* artery is wounded and the aperture is large, and the flow of blood not opposed, the loss of blood will be so rapid as to occasion death at once; but if the wound be very small, it may be closed by coagulated blood during syncope, and the patient, if properly treated, may survive.

If the artery be of the second order, as the tibial, the bleeding will most probably cease when syncope supervenes; but when the faintness has passed off, the bleeding will recur, and the patient may die, unless the bleeding be checked by the surgeon.

A puncture or partial division of an artery is sometimes more troublesome than a complete division, because *contraction* and *retraction* are prevented. An oblique cut is likely to bleed obstinately; the aperture may, in favorable cases, be closed by adhesion, the artery remaining pervious; the uniting lymph, not infrequently, is dilated into a *false aneurysm.*

Treatment.—In the wounds of arteries the first indication is to stop the flow of blood. If the wound be small, and there is a bone underneath, the bleeding may be arrested by firm pressure of the finger; if the wound is wide and deep, the forefinger should be passed in, and pressure should be made with it on the exact spot from whence the blood issues, or the bleeding orifice should be seized with the finger and thumb; or the bleeding may be stopped by pressing the main artery above the point of injury; or a tourniquet may be applied; or, if no tourniquet be at hand, a handkerchief, with a stone placed in it, over the artery, may be tied around the limb, and twisted tight with a stick.

The immediate danger being averted, the surgeon next considers the best means of permanently arresting the hemorrhage.

Hæmostatic Methods: (1) The ligature, (2) acupressure, (3) torsion, (4) elevation, (5) compression, (6) styptics, (7) actual cautery, (8) forced flexion of limbs.

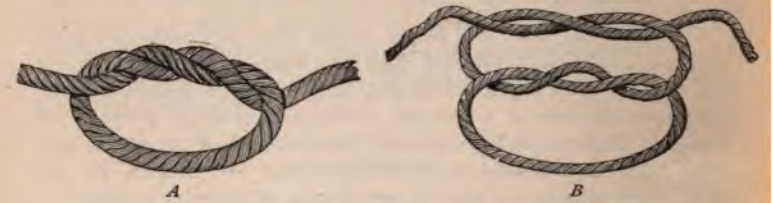

FIG. 16.—Surgeon's Knot. *A*, single; *B*, double.

The Ligature.—If the orifice of the artery projects, it should be taken hold of with the forceps and gently drawn out; then an assistant should tie a ligature properly around it. As a rule, the ligature should consist of small, round hempen thread, flossed silk, twisted silk, or catgut, tied so as to divide the internal coat of the vessel; if the artery is diseased and brittle, the ligature should be large and not tied too tightly. In atheromatous degenerated arteries the internal coat must not be cut through. A double ligature or the stay knot of Balance and Edmonds is used by many.

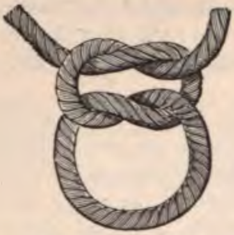

FIG. 17.—Reef Knot.

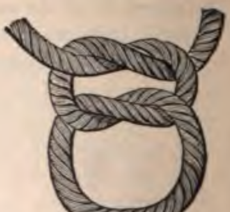

FIG. 18.—Granny Knot.

If the bleeding orifice cannot be drawn out with the forceps, it may be transfixed with the tenaculum; in some cases it may be necessary to pass a curved needle and ligature through a considerable degree of the flesh, and tie all up together. After tying, the ends of the ligature should be cut off, but not too close to the knot. The ligature either becomes encysted or is absorbed.

In all cases *where it is possible,* a wounded artery must be tied at the wounded part. If this be not practicable, the next best plan will be to tie the artery ascertained to be the wounded one as near as possible to the bleeding point, and repeat this process at the distal side if bleeding occurs from that end.

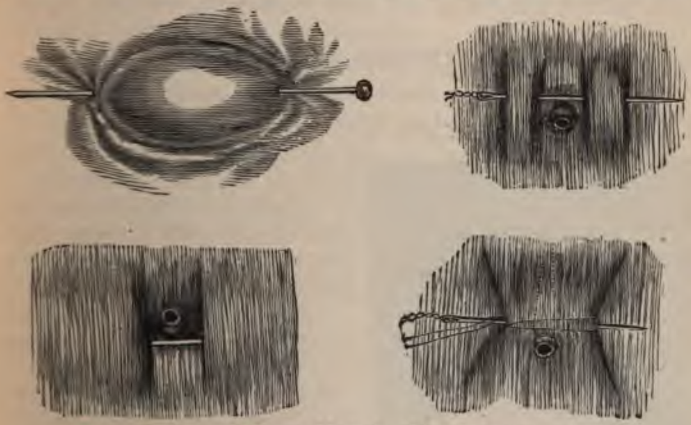

Fig. 19.—Different Methods of Acupressure.

Acupressure.—This is pressure applied by means of a long pin. This method though useful is not of general use for by means of modern instruments we can generally place the ligature. Acupressure is used at times upon inflamed and diseased arteries in scar tissue in sloughing wounds and where the ligature cannot be made to hold.

There are several different forms of acupressure: (1) The pin passed under the vessel leaving a small margin of tissue on either side (transfixion). (2) Pin passed under vessel as in transfixion and wire passed over each end of pin and twisted so as to occlude vessel (circumclusion). (3) The pin can be inserted some distance from vessel passed through about one-half inch of tissue and inserted on opposite side after twisting so as to maintain constant pressure upon vessel (torsoclusion). (4) Tissue may be pinned across the vessel (retroclusion).

Torsion.—This is performed by drawing out the vessel from its sheath, by a pair of *broad-pointed* spring forceps, and then twisting it around freely, as far as its natural connections will allow, usually an artery can be twisted six to eight times; or it may be performed by drawing out the vessel, fixing it by one pair of forceps a quarter or half an inch from the end, and then with another pair twisting the end around until it does not untwist itself. Torsion is dangerous and unreliable and should only be used upon the smallest vessels.

INCISED WOUNDS.

An **Incised wound** is a division of the parts, more or less extensive, according to the extent of the injury.

The fibers have only been simply divided; there is no contusion or laceration; hence they are not likely to take on severe inflammation, nor are they apt to slough or suppurate.

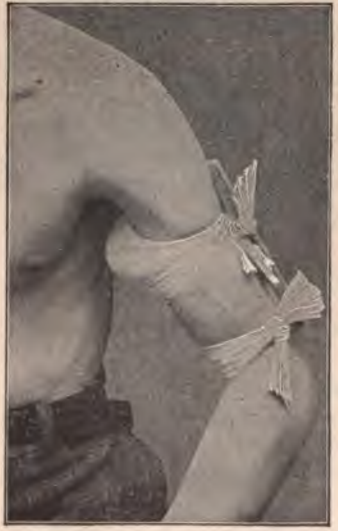

FIG. 20.—Spanish Windlass, for control of hemorrhage by pressure.

Upon the extent and color of the hemorrhage the surgeon is enabled to judge of the kind of vessel injured; if an artery is wounded, the blood flows rapidly in jets and is of a florid color; if a vein, the bleeding is slow and the blood is of a purple color.

Treatment.—In a recent incised wound the indications are to check the bleeding, remove all extraneous matter, and to bring the parts in perfect apposition.

To check the hemorrhage, steady and continued pressure upon the surface, with a sponge wet with hot corrosive sublimate solution, will be sufficient, as a general rule. Should the hemorrhage proceed from a vessel of some size, a ligature should be applied.

So soon as the bleeding ceases, all clots are to be completely sponged away and all foreign bodies must be carefully removed; the edges are then to be brought together in their entire extent, retained in contact by means of sutures. The wound being dressed, the parts must be placed at rest, in a relaxed position.

The wound must not be entirely closed, lest the secretions be retained; if this be allowed to take place infection may follow, and there will be risk of septicæmia. Drainage must be provided for by means of drainage tubes: gauze or silk-worm gut. Drains should be placed in the wound before it is closed, care being taken not to let them remain in too long. When the bloody serum ceases to flow the drain must be removed, unless there is prolonged suppuration.

Elevation is useful in capillary oozing and is generally used in conjunction with cold and pressure.

Compression.—This may be made upon the artery in the wound or at a convenient point upon the proximal sides. In some cases where collateral circulation is well established the distal end must be compressed. In hemorrhage from veins compression is very useful; it is also used for the control of bleeding from the cerebral vessels. Iodoform gauze is packed between the brain substance and the skull. The Esmarch band or a tourniquet may be applied to a limb for the control of hemorrhage.

Styptics.—These are rarely used owing to the danger of infection. The best styptics are adrenalin chloride, Monsell's solution, tannic and gallic acids, hot water 115° to 120° F.; mixture of equal parts alcohol and water to control capillary oozing.

Resort may be had to the internal administration of chloride of calcium in an initial dose of 15 to 20 grs., then follow by 5 grs. every hour.

Carnot's gelatin solution is of great use in persistent capillary oozing. This may be used locally or injected into the tissues. Disease of kidneys is a contraindication for its use hypodermically.

Forced flexion of limbs may be done in conjunction with pads placed in joints and all bandaged in position. This is applicable in control of hemorrhage from hand and foot.

The Cardinal Rules of Hemorrhage are:

1. Tie artery in wound, enlarging if necessary (Guthrie's Rule) from Da Costa.

2. In wounds of superficial palmar arch cut down and ligate both ends of bleeding vessel. In those of deep palmar arch ligate if possible,

securing ample room for proper manipulation. In extreme cases the brachial has been ligated and it might be necessary to amputate.

3. Lateral wounds in veins and arteries may be repaired by suture or ligation.

4. Bleeding from bone can often be controlled by the use of Horsley's wax or strands of gauze packed into the diploe.

5. Severe hemorrhage necessitates absolute rest in bed and elevation of parts.

6. In intra-abdominal hemorrhage operate and control by ligature or pads.

Dress the wound antiseptically. If the biceps be divided, the limb must be bent at right angles; if the triceps be injured, extension will be necessary.

LACERATED WOUNDS.

Lacerated wounds are those in which the fibers, instead of being divided by a cutting instrument, have been torn asunder by violence.

The edges of the wound are ragged and irregular; there is little pain or hemorrhage, and the surrounding parts, frequently bruised and discolored, are cold and numb.

A lacerated wound differs from an incised one, in the slightness of the pain and hemorrhage; in its tendency to suppurate and slough, and in its liability to be followed by erysipelas, septicæmia, pyæmia, tetanus and other symptoms, apparently of nervous origin.

When the lesion is very extensive, the attendant shock being necessarily severe, local sensation is obliterated, but when reaction takes place the pain is frequently intense.

The Treatment of lacerated wounds does not greatly differ from that of incised wounds. All foreign bodies must be removed, the vessels tied, the edges gently approximated. Guard against secondary hemorrhage by applying, if possible, a provisional tourniquet to the part, to be tightened on the slightest appearance of blood. Great care must be taken to select a sound portion of the artery when the ligature is applied. Venous hemorrhage may generally be controlled by a compress and roller. All tension is to be carefully avoided, and the edges are to be trimmed with scissors and the wound closed with sutures, using drainage tubes if necessary.

To moderate the inflammation hot saline irrigation is to be used. Should suppuration present itself, spray the wound with peroxide of hydrogen, wash with corrosive sublimate solution and dress antiseptically. Should the inflammation run high and gangrene be threatened, purgatives should be used and antiphlogistic regimen observed.

Anodynes, to allay pain and produce sleep, must be freely given. Reactionary hemorrhage may arise as soon as reaction takes place. Secondary hemorrhage may occur when the sloughs begin to separate; this will likely take place in five or six days from the date of the injury and should be carefully guarded against, especially if a large artery is involved.

CONTUSED WOUNDS—OPEN.

Contused wounds are usually produced by greater violence than the preceding, and are accompanied with greater disorganization; blood is extravasated, cellular tissue is broken down, muscles bruised, and the surrounding parts are apt to be disorganized.

They bleed but little, in consequence of the organization of the parts being destroyed. The pain which accompanies a wound of this kind is in inverse ratio to the amount of the injury. When there is a moderate contusion the pain is generally severe, and when there is a violent degree of contusion the patient scarcely suffers any pain until reaction sets in.

Treatment.—If there is hemorrhage, it is to be controlled in the usual manner, by compression, hot water and ligatures. When an artery lies exposed in contused wounds, ligatures should be applied both above and below the point of lesion. The edges of the wound must be brought together gently, allowance being made for swelling and drainage. If it be necessary to use sutures to bring the parts together, it is proper to do so.

Apply the usual antiseptic dressings. Pain and nervous symptoms are controlled by anodynes and antispasmodics.

CONTUSED WOUNDS—SUBCUTANEOUS.

Contusions producing subcutaneous injuries are caused by blows from a hard blunt object, or by violence applied to the injured part. The surface is not broken, but, as a rule, blood is extravasated under the skin. The injury is to the soft parts under the skin; the connective tissue with its delicate vessels primarily; then the muscles may be crushed or torn; next the lymphatics and arteries; the nerves show the most resistance, though they may be violently stretched.

Contusions vary in degree from a trivial bruise to absolute crushing of the part. In the slightest cases there is no perceptible bruise—

merely redness and swelling, with local pain, which soon subsides; in those that are more severe there is ecchymosis, some of the capillaries being ruptured, blood effused into the skin or subcutaneous tissues, when swelling and discoloration make their appearance. In the worst cases the amount of extravasation may be enormous, as where a large vessel has been ruptured, or where the tissue is easily torn. The scrotum, or the loose cellular tissue of the female genitals, may be swollen to an enormous size. From hemorrhage alone, the case may prove fatal almost at once.

The changes that take place in the part depend upon the amount of extravasation, the tension, the nutrition of the surrounding tissues, and the treatment that the injured part has received. *Absorption* is the rule, but if the tension is great, as when a large artery is severed, or if the part is not kept at rest, or if the surrounding tissues are badly nourished, inflammation may ensue, when *suppuration* is very likely to follow.

The degree of swelling, of course, varies with the amount and situation of the extravasation, and the looseness of the tissues. As a rule, the pain depends upon the amount of tension. In some instances the shock is very severe, as when the testis is squeezed, or the abdomen struck. If a large vessel is torn, the loss of blood may at once prove fatal. When the bruise is superficial, the staining of the skin will soon show itself; when deep, it may not appear for weeks.

Traumatic fever is a usual accompaniment, and in cases of large extravasations may be very severe, lasting for several days.

Treatment.—Slight contusions are best treated with cold or evaporating lotions. Lead water and laudanum, or acetate of lead in a decoction of powdered opium, are especially useful. There the extravasation is considerable, uniform, gentle compression with many layers of cotton wool checks the increase, limits the hyperæmia, and promotes absorption. This treatment will be found efficacious even when bullæ are forming upon the skin. The fluid should be drawn off through a minute puncture, absorbed with sterile cotton wool or gauze, the epidermis carefully replaced, a little iodoform dusted on, or collodion painted over, and then a gauze carefully applied.

In very severe cases where there is risk of suppuration, the tension may be relieved by the aid of the aspirator. Only a small portion of the fluid need be removed—sufficient to relieve the tension; this will at once diminish the hyperæmia, when absorption will proceed unchecked.

The contusion is sometimes so severe as to kill the skin. If the injury be small, and the deep structures not badly implicated, the slough should be allowed to separate itself; but where the skin has been stripped off from the subcutaneous tissue to some distance above the apparent seat of injury, and it is thought advisable to amputate, the line of incision must be carried well above, or the flaps will be sure to slough.

PUNCTURED WOUNDS.

A punctured wound is one made with a narrow-pointed instrument, such as needles, nails, splinters, swords, bayonets, scissors, hooks, etc.

These wounds are much more dangerous than cuts or incised wounds, from the effects they produce on the injured part.

A slight punctured wound through the skin into the cellular tissue will sometimes be followed by red lines along the course of the absorbent vessels, from the wound to the absorbent glands.

If a tendinous structure be punctured, alarming symptoms will frequently follow.

In punctured wounds their depth is usually much greater than their width, making it frequently difficult to determine the amount of injury inflicted.

The pain is often very great, depending upon the injury sustained by the nerves. Punctured wounds are rarely attended with much hemorrhage, and sometimes with hardly any.

They are very liable to be followed by erysipelas, lymphangitis, tetanus, abscess, and wasting of the muscles from injury to nerves.

The treatment consists in the extraction of foreign substances, if there be any, in checking hemorrhage, in moderating inflammation, and preventing the development of nervous symptoms.

All such articles as fish hooks and similar barbed objects must be extracted by counter-openings, or pushing them through the part in which they are imbedded.

If bleeding arises by reason of an artery having been laid open, it must be exposed and tied at both ends. Great care must be exerted to see that full and sufficient drainage is established. It is always best and frequently absolutely necessary to change a punctured wound into an incised wound by free incisions. This practice should always be adhered to when possible.

A cardinal rule in punctured wounds is to always examine the puncturing implement and note whether it is intact.

Should the puncture have been made by a suspicious medium containing dust or soil it is well to give an immunizing dose of tetanus antitoxin, and swab the wound with pure carbolic acid, followed, if necessary, by alcohol.

GUNSHOT WOUNDS.

Gunshot wounds are injuries caused by substances discharged from firearms, by fragments of stone or wood struck thereby, and by the bursting of firearms and shells.

The symptoms are local and general, and vary in character, according to the extent of the lesion, the importance of the tissues involved, and the idiosyncrasy of the individual.

The pain is often insignificant, and a person severely hurt may not be conscious of having received a wound until some time after it has been inflicted. The pain is of a dull and heavy character, unless a nerve is struck, when it will be sharp, severe, burning or pricking.

Bullets penetrating the flesh usually produce a burning sensation more or less acute. When bones are broken stinging accompanies the burning. When bones are hit but not broken, there is a numbing sensation in the whole region involved in the shock, followed very soon by severe and sometimes intense pain. When muscles and tendons are involved, there is a tugging sensation, sometimes very slight; shell wounds produce feelings similar to those by bullets, more or less exaggerated, according to the size of the missile and the degree of velocity.

A spent cannon shot, *i. e.*, a ball slowing up and rolling along the ground at the rate at which a man moves when walking, will crush the bones of the foot or leg that resists or opposes it. A cannon ball having sufficient velocity to keep in the air will make a clean cut of flesh, bones, and ligaments.

The suffering is generally great when a bone is broken, a large joint penetrated, or a visceral cavity opened.

Owing to the contused and lacerated nature of the lesion, hemorrhage in gunshot wounds is not in proportion to the severity of the injury, unless an artery be laid open; the hemorrhage is generally external, the blood issuing from both orifices of the wound.

In wounds of the chest, abdomen and pelvis, the hemorrhage is usually internal.

Gunshot wounds are exceedingly liable to secondary hemorrhage. When secondary hemorrhage sets in, as the result of sloughing, it usually arises between the tenth and fifteenth day.

The shock in these injuries is generally most intense when the ball traverses the head, chest, abdomen or pelvis.

Treatment.—The indications are to promote reaction, arrest hemorrhage, ascertain the condition of surrounding parts, extract all foreign bodies, remove loose pieces of bone, if any, and endeavor to control resulting inflammation. Always examine for the presence of a wound of exit. This when present is generally large.

A probe is used to examine the wound; either the long metal probe or the porcelain tipped instrument of Nélaton may be employed. This probe is not applicable to the modern bullet because of its great hardness. A piece of soft pine wood or a clay pipe stem may be substituted for the ordinary probe. When examining wounds of the brain aluminium probes should be employed. Never probe unless prepared to immediately extract the bullet. Promiscuous probing in the hands of the unskilled has been responsible for many deaths from shock and infection.

Reaction is brought about by employing the ordinary restoratives; the patient must be placed in the horizontal posture; cold water should be dashed in his face; he must be made to inhale the fumes of ammonia water. If necessary, sinapisms must be employed, as well as stimulating injections used, and if he is able to swallow, brandy should be given him, or wine, or ammonia properly diluted.

If the hemorrhage be capillary, it will probably soon cease; if not, cold water, pounded ice, or some mild astringent lotion should be used; if, however, the hemorrhage proceed from an artery, the ligature must be promptly resorted to.

Before deciding upon the condition of the wound, care must be taken to ascertain if there be any foreign substance present, and if there be, to remove it, and also whether any neighboring bone be injured.

The next point is to hunt for, and, if possible, extract the ball. If more harm would result by attempting the removal of the ball than by its remaining in the wounded part, it should not be disturbed. Careless probing for bullets is a pernicious practice and is entirely too frequently resorted to by unskilled surgeons. The best probes are those of Fluhrer, Nélaton and Lilienthal. The Nélaton instrument is not reliable for modern projectiles because of their hardness. All probes should as far as possible correspond in size at the tip to the calibre of the projectile.

The best means of locating a bullet in the body is by an X-ray photograph. Dr. W. M. Sweet has devised a localizing apparatus for this purpose that is most useful, accurate and ingenious.

Bullet forceps are used to extract the missile when located. The modern forceps has small serrated jaws corresponding in size to the calibre of the bullet.

The modern high-power rifle produces a different wound from the older low-power arm, and, as Sir Frederick Treves says: "The Mauser bullet is a very merciful one." The modern projectile tends to perforate rather than lacerate. It as a rule remains intact because of its great hardness, and rarely stops within the body, owing to its power of penetration.

The modern bullet in some instances does much damage at ranges under fifteen hundred yards (Senn). Within this distance it produces a sort of explosive effect upon the tissues and is capable of pulpifying structures. Beyond fifteen hundred yards it tends to puncture. The explosive effect is thought to be due to its great velocity and also its rapid rotation. Hemorrhage is usually greater from wounds inflicted by the modern bullet because of a lack of contusion unless the individual be hit within the explosive range.

Blank Cartridge Injuries.—These occur only at close range and usually are inflicted by powder grains, pieces of wad or cap. Tetanus is very liable to follow and the wound should be thoroughtly cleansed and cauterized by carbolic acid and alcohol. Always give an immunizing injection of anti-tetanic serum.

To control resulting inflammation, great care must be taken to properly dress the wound by gently applying a roller, if necessary; put it on in such a manner as not to impede drainage.

The usual aseptic dressings are to be employed.

DISSECTION WOUNDS.

Dissection wounds are those contracted in the examination of dead human bodies.

Symptoms.—The disease commences at the inoculated part, from whence it spreads.

The first symptom that attracts attention is a stinging or burning sensation; upon examining the part a little whitish vesicle is observed, extremely sensitive on pressure. When the vesicle breaks a small ulcer is exposed. The pain by this time is very great, the sore enlarges, the swelling increases, and the part feels hot, tense and numb. A red line is usually seen extending from the point of inoculation, along the arm to the axilla. As the disease spreads the whole limb becomes enormously enlarged, pitting on pressure, and looking dusky and erysipelatous.

Cases occur where the symptoms begin at the axilla and extend from thence up the neck and down the side.

In the worst forms the disease soon reaches a crisis; the system rapidly falling into a typhoid state.

Treatment.—As soon as a wound of this kind is received it should be thoroughly washed with warm water, soap, alcohol and bichloride of mercury; this should be followed by suction by the mouth. If the wound is small it should be dilated; if it has bled, thoroughly cauterize with acid nitrate of mercury, or nitrate of silver, hydrochloric, nitric, sulphuric acid or pure carbolic acid; dress with hot antiseptic fomentations and keep wound well open.

If a vesicle forms it should be freely opened, and then thoroughly cauterized; antiseptic dressings should be applied, and, if necessary, a purgative administered. To relieve the excessive pain and restlessness anodynes should be freely employed, and if the skin be hot and dry aconite or veratrum viride should be administered.

To meet the typhoid symptoms, milk punch, quinine, iron and other such treatment should be resorted to as will support and sustain the patient. Alcohol is a mainstay in all pyogenic infections and must be freely used.

WOUNDS OF THE THROAT.

The usual causes of these injuries are attempts to commit suicide; the parts injured are the pharynx, larynx, trachea or œsophagus.

In these cases the carotid is rarely reached, owing to the incision being made high up, and to the head being thrown backward.

The larynx is most frequently injured; it is characterized by air and blood issuing from the wound with great rapidity, especially when the patient coughs. The arteries that are usually wounded are the sublinguals. Should the external carotid be divided, death would ensue before assistance could be rendered.

When the injury is above the larynx, the lips of the wound must be carefully brought into apposition and kept in place by sutures. The head must be brought down upon the chest, and confined in that position, in order to prevent a separation of the edges of the wound. If there be a tendency to œdema of the larynx, intubation, or tracheotomy must be performed.

The mouth must be kept cool and moist; and for this purpose a slice of lemon dipped in water, or a wet rag, or pieces of ice, may be inserted from time to time.

The patient should be carefully nourished, by nutrient enemata, with opium added, if necessary, and when food is given by the mouth, it is best to commence with semi-solids, such as jelly, etc. If he is unable to swallow he may be fed by means of a stomach tube.

If the wound is in the thyroid or cricoid cartilages, the air rushes through the aperture in expiration, and violent coughing is produced. The treatment is the same as in the preceding case.

When the injury is inflicted within three inches of the sternum, it is more dangerous than in any other situation; here the trachea is in the forepart, the œsophagus behind, and the carotid arteries are close to the trachea.

The first object is to stop the bleeding; and if the opening is not sufficiently large, an incision should be made in a longitudinal direction, to expose the mouth of the vessel, in order to secure it with the least possible delay. The wound is not to be entirely closed, otherwise emphysema may ensue.

GUNSHOT WOUNDS OF THE CHEST.

These may be divided into the *non-penetrating* and the *penetrating*. The non-penetrating are those affecting the soft parts and the ribs; the penetrating are those in which the lung is directly injured. The missile may pass through entirely or partially, and lodge in the pleural cavity, or it may pass directly through the chest and lung.

Symptoms.—More or less collapse, depending on the time that has elapsed since the wound. Face anxious, breathing labored, respirations frequent. Blood expectorated in more or less large quantities; air generally found passing from surface of wound, and usually there is emphysema in the neighborhood.

Treatment.—Patient must be placed in bed and careful search made for the ball; when there is no counteropening, the ball may be often found on the opposite side. Splintered fragments of ribs should be removed and any sharp ends of bone rounded off. If the collapse is not severe the patient should not be disturbed, so that an opportunity may be given for clots to form and bleeding to cease.

A light antiseptic dressing should be placed over the wound and the patient carefully watched.

WOUNDS OF THE JOINTS.

A wound may usually be known to have penetrated the joint by the escape of synovia, though this is not invariably the case.

Treatment.—The parts must be shaved, carefully cleansed, and dressed antiseptically, due regard being had to free drainage.

The limb must be absolutely immovable, and for this purpose a proper splint must be applied. The Plaster-of-Paris splint is usually employed. It is always wise to place the limb in that position where it will be most useful; for anchylosis very often follows.

QUESTION OF AMPUTATION IN WOUNDS.

Amputation should never be performed until reaction has set in.

It should be resorted to when the limb has been run over by a heavy vehicle, crushing the bone and tearing open the soft parts; when, in addition to serious injury inflicted upon the integuments, muscles or bones, the principal artery, vein, or nerve has been lacerated; when a large joint is penetrated, accompanied by comminuted fracture. If mortification sets in, amputate high up. If it is an injury of the leg, and the bones are shattered, and the posterior soft parts are not lacerated, and the main artery is intact, an effort should be made to save the limb.

HYDROPHOBIA.

This disease is the result of poison, caused by inoculation with the saliva of rabid animals.

Symptoms.—The first symptom a person experiences who has been bitten by a rabid animal is pain in the injured part, and this may be felt between the second week and third month. Some claim that it may develop two years after a bite. The next symptoms are low spirits, a sense of chilliness, succeeded by rigors and heat, headache, stiffness of the neck, soreness of the throat; then a difficulty of swallowing is felt, not of liquids in particular, but of any substance; so that the patient avoids making an effort; but upon applying a cup to his lips, he will be seized with the most painful shuddering; he will turn away to avoid the sight of what he was about to take, and sit down in a state of exhaustion.

From this time the most prominent symptoms will be difficulty of breathing and swallowing, extreme irritability of the body and disorder of the mind. The organism responsible for rabies has not been discovered; there are no constant pathological lesions. Gowers believes there may be a hyperemia of the spinal cord. The disease may appear at any time of the year.

Treatment.—Immediately after the individual has been bitten, place a tight ligature above the affected part, and, if possible, at once have the wound vigorously sucked, and then, as soon as may be, cut it out and thoroughly cauterize the whole. Mr. Youatt prefers nitrate of silver, but many authorities place a small piece of potassa fusa into the wound, allow it to dissolve, when its cauterizing influence will be communicated to all parts of the wound.

It does not appear that there is any cure for this affection. The general treatment should be that indicated under the head of tetanus. The patient should be sent at once to the nearest Pasteur institute for treatment.

M. PASTEUR'S METHOD OF TREATMENT OF PERSONS BITTEN BY RABID ANIMALS.

As M. Pasteur's method of treating persons who have been bitten by rabid animals has attracted considerable attention. The following synopsis of his mode of conducting a case of the kind is here engrossed:

The substance used for inoculation is perfectly pure veal broth, exempt from any microbe, in which has been dissolved a little of the spinal marrow of a rabid rabbit. The broth, carefully prepared, is put in a glass receiver of spherical form, with long neck hermetically sealed. It is then submitted for half an hour, under pressure, to a heat of 239° F. This boiling is for the purpose of destroying all germs. When perfectly clear, it is decanted in one of Pasteur's receptacles. To obtain the infected marrow, a rabbit having been chloroformed and trephined, the infected broth is injected under the dura mater, when the edges of the wound are stitched together, and the rabbit is left to recover.

After inoculation, rabies declares itself in the rabbit at the end of six days. Two or three days later the animal dies. The spinal cord is carefully extracted and hung up in a flask containing caustic potash. It is placed in a room kept at a heat of 68° F. When the infected substance is to be used, a piece about a centimeter in length is cut off and mixed with pure broth. The first day the patient receives half a hypodermic syringeful of broth, with marrow of thirteen days' strength. The following day the patient receives a hypodermic of twelve days' strength. Each day the marrow is one day younger. The operation is repeated daily for twelve days.

BURNS AND SCALDS.

Burns and scalds are divided according to their severity; those which produce mere redness, followed by desquamation of the cuticle, and those attended with destruction of tissue. For practical purposes burns and scalds may be classed under three heads:

1. Simple erythema without vesication.
2. Erythema plus vesication and bullæ.
3. Carbonization of the parts and destruction of the deeper structures accompanied by sloughs and great shock.

Symptoms.—The severity of the constitutional effect of burns depends on their extent rather than their depth; it is likewise modified by their situation and by the age of the patient.

An extensive burn is more serious in its immediate results than a smaller though deeper burn. Burns of the chest, abdomen, head and face, are followed by much more severe symptoms than more extensive burns of the extremities.

The earliest symptoms are those of shock; the skin is cold, accompanied by shivering; the pulse is rapid and feeble, sometimes thready; the pain is severe, and of greater intensity in slight than in deep burns; in the worst cases it is nearly or quite absent. In children, vomiting is an early symptom. When the mouth and pharynx have been scorched there is thirst and dysphagia; the urine is scanty, frequently albuminous and bloody. The patient may lapse into a drowsy condition, followed by coma and death; or there may be restlessness, delirium and clonic spasms.

If life be prolonged, reaction sets in after twenty-four or forty-eight hours, and the general febrile symptoms of traumatic fever present themselves; these symptoms are kept up by the absorption of inflammatory products, and if decomposition takes place there will be septic poisoning. Constipation is followed by diarrhœa, which is often profuse and exhausting.

A singular accompaniment of severe burns is a liability to be followed by acute ulceration of the duodenum (Curling's ulcer); this may terminate fatally by perforating the intestine and causing peritonitis.

Pulmonary complications frequently occur.

The process of separation of the sloughs is usually completed by the end of the second week, when the stage of suppuration begins. Weakness is often extreme, and death may ensue from exhaustion.

As consequences of burns and scalds, vicious scars are formed, and contiguous surfaces are apt to adhere together, with retraction of the affected part, producing ankylosis of the neighboring joints and terrible distortion.

Treatment—Constitutional.—A stimulating plan of treatment is almost invariably necessary, and depletion is rarely advisable even in the presence of inflammation of internal organs. In the first stage the aim is to establish reaction and relieve pain.

To raise the system from the depression into which it frequently sinks, anodynes should be resorted to early, and given in large quantities. The strength must be maintained by nutritious diet, together with stimulants; quinine, ammonia and hot brandy and water should be freely resorted to. Sinapisms should be applied along the spine. Diarrhœa must be arrested by astringents and opiates.

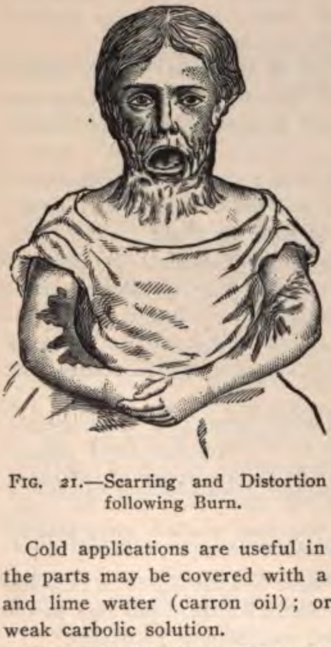

FIG. 21.—Scarring and Distortion following Burn.

Local Treatment.—In the local treatment of burns, the protection from and exclusion of air from the burnt surface, and the prevention of decomposition are the indications. The body should be exposed as little as possible. The use of antiseptic dressings, which seldom need renewal, will avoid the necessity of frequent change, and this is very desirable.

The severe pain is promptly relieved by the use of bicarbonate of soda, either applied in the form of paste made with water, or freely sprinkled over the raw surface.

Cold applications are useful in many cases, especially in summer; or the parts may be covered with a liniment of equal parts of linseed oil and lime water (carron oil); or a lead lotion may be applied, or a weak carbolic solution.

Lint soaked in Goulard's water is a remedy in frequent use.

Iodoform, which acts as a local anæsthetic, may be sprinkled over the surface if signs of decomposition appear.

S. D. Gross recommended an application of a weak solution of nitrate of silver to allay the scalding and smarting sensation. Mucilage of gum acacia, or mucilage of gum acacia mixed with linseed oil and lime water, has been found useful. One of the best dressings is a thick layer of sterile gauze, heavily spread with vaseline, dusted with iodoform. Sterile gauze saturated with a 1 per cent. watery solution of picric acid is a very useful dressing for burns of limited extent. Irrigation with salt solution is also useful.

Ulcers resulting from deep burns are extremely intractable; they secrete pus profusely, and often many months elapse before they are healed.

In such cases, mild stimulants and astringents are advisable; especially carbolate of zinc lotion and bismuth ointment. When the discharge is very profuse, the sore should be kept constantly covered with finely-powdered chalk, or subiodide of bismuth. Skin grafting is frequently resorted to, with successful results. Where great destruction has occurred amputation may be necessary; if the injury be near or involving a joint the use of splints and methods of traction to limit contraction and deformity is most essential.

ULCERS.

An Ulcer is a solution of continuity in any of the soft parts of the body, attended with inflammation and a discharge of pus, ichor, or sanies.

Ulcers are divided into *acute* and *chronic,* according to the intensity and rapidity of the morbid action.

The ordinary ulcer may have begun as a wound or bruise, abscess, or other disease or injury; the granulations are small, numerous, florid and pointed, and yield a moderate secretion of pus.

Cicatrization begins with an absorption of swelling around the wound and a contraction of its margin; its edge begins to look smooth and bluish, and a thin pellicle of new cuticle gradually spreads from the edge, in a converging circle, till the wound is closed.

An acute ulcer is distinguished by the rapidity of its progress and the severity of its symptoms.

The pain is often a prominent symptom; it varies in character, being sometimes throbbing and again sharp and pricking, dull, heavy, and gnawing.

When the ulcerative action is rapid and extensive, there is more or less fever, with thirst, restlessness, loss of sleep, and excitement of the pulse.

The tissues most disposed to ulceration are the skin and mucous membranes; the areolar tissue ulcerates very easily; muscles, blood-vessels, and nerves very slowly; tendons and ligaments are very slow to ulcerate; but cartilage, bone, and the cornea are sometimes extremely liable to it.

Treatment.—In *acute ulcers* the patient should be kept in bed, with the limb raised on a pillow; saline purgatives must be administered. Calomel and blue mass should be combined with a saline cathartic. Pain must be relieved by opiates. Soothing applications, such as poppy lotion, or acetate of lead and opium, should be resorted to; cold or warm lotions, as are most agreeable, should be applied.

In many cases a tonic and stimulating treatment will be better suited to the patient; when used, quinine and iron are the remedies most in vogue, and a diet nutritious and generous must be added.

Under the influence of rest, elevation, and the remedies here prescribed, the inflammation will disappear and granulations will begin to make their appearance. If the bottom of the sore is foul, sprinkle it with iodoform.

When healing commences strips of adhesive plaster should be applied *two-thirds around the limb,* from an inch below the ulcer to an inch above it; the plaster should be so applied that the edges of the sore may be drawn together with a moderate degree of force; then a compress of soft linen should be placed over the plaster, and finally the limb should be bandaged from the toes to the knee. The parts should be kept clean and washed every day with soap and water.

Phagedenic Form of Acute Ulcer.—This variety of ulcer spreads with great rapidity, destroying everything within its reach. It is frequently met with in persons broken down with disease or who are much debilitated. The bottom of a phagedenic ulcer is liable to be covered with a slough which is of grayish color. The discharge is serous, profuse, and highly offensive.

Treatment of Phagedenic Ulcer.—Cleanse the part by soaking up with absorbent cotton all the discharges from the ulcer that may be present; then destroy the edges of the ulcer with some one of the acids or other caustic. When this has been done, touch the edges of the sore with absorbent cotton saturated with nitrate of mercury one part, water eight parts, and insert the cotton under the undermined edges of the sore. Having done this, sprinkle the edges with iodoform. Surrounding the slough is an acutely inflamed surface; paint this with the tincture of iodine and dress the limb with a hot solution of acetate of lead and laudanum, keeping the parts in an elevated and relaxed position. Give the patient nourishing diet, quinine and iron, with stimulants if necessary. If the pain is severe, administer one grain of opium every eight hours.

In the irritable form of acute ulcer, when, in addition to the surrounding inflammation, the ulcer itself is not only the seat of intense pain, but is extremely sensitive to the touch, the best mode of treating the irritated points is to insert a bistoury underneath them, make a small incision, and divide the nerve; then paint the surface with a solution of nitrate of silver, gr. x to water ℥j; dress with solution of chloral hydrate of like strength, as recommended by Professor Keen.

A Chronic Ulcer may be the sequel of an acute ulcer, or it may be chronic from the beginning. It is characterized by slowness of progress, and the comparative absence of constitutional symptoms; it has its surface smooth and glassy, more or less irregular, and is of a pale ashy color; sometimes it displays a crop of weak granulations; the edges are raised, thick, white, hard, or callous and insensible; in some cases they are thin, ragged, and serrated, the discharge being scanty and thin.

Ulcers are frequently stationary for a great length of time, and from slight causes may enlarge rapidly, by ulceration or sloughing; and even when they have made considerable progress in healing, they may without any manifest reason quickly retrograde.

A varicose ulcer is one that is seated on a leg the veins of which are varicose.

For the treatment of chronic ulcers all the mineral and vegetable astringents may be tried in turn: mercury, tannin, catechu, zinc, iron, copper, alum, silver; for general use, sulphocarbolate of zinc is one of the best; it contains the astringency of the zinc, with the antiseptic virtues of the carbolic acid. For reducing thick, callous edges, the ointment of nitrate of mercury is greatly praised. Acid nitrate of mercury, diluted with eight or ten parts of water, is highly recommended. Fetor is allayed with the chlorides.

The treatment of varicose ulcers and of chronic ulcers generally by the use of Baynton's plan of inclosing the limb in strips of adhesive plaster, regularly applied from the foot upward, has long been in use. Preference is given to the elastic bandage recommended by Dr. Henry A. Martin, of Boston.

In varicose ulcers ligation of the veins may be necessary.

If the ulcer depends upon necrosed bone, it must be extracted, and any carious bone should be scraped away, or removed with the chisel, gouge, or scalpel.

GRANULATIONS

Sinuses are to be laid open with the bistoury, guided by the director. are small vascular prominences consisting of embryonic tissue growing on the surface of wounds or ulcers, by which the healing process is carried on.

If the surface of an exposed wound be examined, it will be found that within a few hours of its exposure it is covered with a film of peculiar, gelatinous, grayish-white appearance.

After an interval of some hours, the parts covered with this gelatinous film become more vascular, as indicated by redness, and the surface becomes more even. After the lapse of twenty-four hours or longer, the surface is covered with a number of elevations, known as *granulations,* varying in size from a millet seed to a hemp seed, the smaller being highly vascular and red, and the larger paler and more bloodless. The wound is granulating; the secretion from these granulations is of a creamy yellow character, and is called *pus.* If the surface is kept in an aseptic condition, there will be no pus. Each granulation contains a vessel, the walls of which consist of a thin membrane in which nuclei are imbedded. Some of these nuclei are arranged longitudinally, others transversely to the axis of the vessels. In the growth of these vessels changes occur, answering to those seen in ordinary embryonic development.

SKIN GRAFTING.

When the *cutis vera* is extensively destroyed and the healing is slow, the process of skin grafting or transplanting cuticle may be resorted to. The process is based upon the law that cuticle can only be produced by skin; the power of skin to set new cuticle growing from its edge so as to cover over a wide surface being limited.

In a very large ulcer which has ceased to heal, new centers of cicatrization may be established, by taking little pieces of skin about the size of a millet seed, including the cuticle and the thinnest possible layer of cutis from the inner side of the upper arm, and planting them flat, at the distance of three-quarters of an inch, upon the raw surface among the granulations of the wound or ulcer, covering and retaining them in position by sterile dressings that have been moistened in salt solution.

The dressings must be allowed to remain four or five days, when the grafts will be found to be firmly attached.

If the grafts are very small, they may be so completely embedded and hidden in the granulations as to be quite invisible for a short time, but in three or four days each point will be seen to have become a little bluish-white islet, from whence the growth of epithelium spreads.

Thiersch's Method consists in using actual portions of skin and covering the whole surface of the sore at the same time.

The surface must be first thoroughly cleansed and washed with normal salt solution (sodii bicarb., sodii chlor., each three-tenths per cent.) and compresses of the same fluid laid over the wound until the strips are ready. The part from whence the skin is obtained (preferably the arm or thigh) must be thoroughly scrubbed with a solution of corrosive sublimate, or iodide of mercury in iodide of potash; then the antiseptic is washed away with the salt solution, and long strips of skin are cut off with a sharp razor, as wide as the parts will allow. The limb from which the strips are obtained must be held firmly from beneath with one hand, so as to put the skin upon the stretch, and a shaving as long as thought advisable is quickly taken from the upper surface. Subcutaneous fat should not be included, but the whole thickness of the true skin is necessary. Strip after strip obtained in this way is placed on the raw surface and pressed firmly into position until the whole is covered. A layer of protective perforated with numerous large openings is placed upon the part, and over this compresses wet with the salt solution, which must be changed daily.

CHILBLAIN—FROSTBITE OR PERNIO.

Severe cold causes an erythematous inflammation of the skin, described as frostbite, the effects of which are designated as chilblain.

The portions of the body that usually suffer are the fingers, tips and lobes of the ear, end of the nose, and the toes.

When the air is loaded with moisture, chilblain is much more apt to be produced than when the atmosphere is dry.

When a person has been exposed to very severe cold, and especially if he has been exhausted by fatigue, hunger, and watching, he feels an irresistible impulse to sleep, which, if yielded to, will soon end in coma and death.

The best remedy for a frostbite is to rub the part well with snow; if snow be not attainable, cold water must be substituted. These applications to be made in a room without fire, and a high temperature must be avoided for some time.

If the cold has induced coma, the best remedy is friction with flannel all over the surface of the body.

Warm drinks must be administered, such as coffee, tea, weak wine and water, to which a few drops of aqua ammonia may be added; if the patient cannot swallow, a rectal enema of milk with a little brandy may be resorted to. When reaction is restored the temperature of the room may be gradually raised.

Stimulating applications are to be used to relieve the itching and burning that accompanies chilblain; of these, tincture of iodine painted over the part; Wardrop's liniment, consisting of tinct. cantharides, ℥iij; linimentum saponis, ℥ix; turpentine, dilute, and carbolic acid, are most highly recommended.

Cod-liver oil, quinine, and tonic treatment generally are necessary.

See Formula 15, at the end of this book.

ERYSIPELAS. (ST. ANTHONY'S FIRE.)

Erysipelas is a diffused inflammation affecting the skin, areolar tissue and lymph channels, due to the streptococcus of erysipelas or Fehleisen.

Clinical Forms.—Cutaneous, cellulo-cutaneous or phlegmonous cellulitis and mucous erysipelas.

Symptoms.—Cutaneous erysipelas most frequently attacks the face and is known by redness of the skin, which disappears momentarily on pressure; the swelling is puffy, with a distinct edge; the pain is smarting, burning, and stinging. The redness is of a vivid scarlet hue, with a tendency to become yellowish if there be much debility. The nearest lymphatic glands are always swollen and tender. The accompanying fever rises rapidly, at times very high, is remittent and generally ends by crisis on the fifth day. Following the disappearance of the fever there is desquamation.

In a vigorous healthy individual the disease is not so dangerous; but in the old or debilitated person its outcome is frequently fatal. Erysipelas may cure an intractable skin disease or a malignant growth.

In the *phlegmonous* erysipelas the redness is deeper; sometimes dusky and purple; the swelling is greater, and is hard and tense; or it may be more doughy and pitting on pressure; the pain is not only burning, but throbbing.

The disease begins with shivering, headache, pain in the back, nausea, vomiting, followed by fever, which is of a low type, especially if the patient be old and weak, or if it be of a hospital origin. Diarrhœa and perspiration may be present from the outset, particularly if the case be asthenic in character.

The *cutaneous variety* may terminate in resolution, with desquamation and slight œdema, or may subside, leaving *bullæ* or vesicles remaining under the cuticle, which dry into scales and peel off, leaving a healthy cutis and sometimes superficial ulcerations.

It may terminate by the appearance of small abscesses.

Ordinary duration is from five to fourteen days.

The phlegmonous erysipelas often leads to diffuse suppuration of the areolar tissue, when the swelling is flaccid and boggy; patches of the skin become purple and slough; the intermuscular tissue and fasciæ may suffer in the same way, and even if the patient escape with his life, the limb may remain permanently useless.

Phlegmonous erysipelas is more dangerous than the cutaneous variety; the disease is particularly to be dreaded when it attacks the scalp. In old persons, the intemperate, and in the very young, the prognosis is very grave. An epidemic of this disease is always more destructive to life than when it occurs sporadically. Traumatic erysipelas is always a cause for grave concern.

The tendency to relapse after the disease has disappeared from the part originally affected is very remarkable.

Treatment.—It is well to begin the treatment with a mild purgative, unless the patient be very weak and delicate; calomel, rhubarb, and compound extract of colocynth are the drugs to be mainly relied upon. When the bowels have been thoroughly evacuated, none but the most gentle aperients should be employed, as blue mass, Seidlitz powders, etc. If there is irritation of the stomach, or diarrhœa, small doses of hydrarg. c. creta, with bismuth, may be used with advantage. If the cutaneous functions are more or less interrupted, diaphoretics are indicated: Dover's powder, with tepid sponging or warm bath, may be used. Anodynes, to allay pain and induce sleep, must be employed. When there is a tendency to prostration, stimulants and tonics must be early resorted to. The tincture of the chloride of iron, alone or with quinine, should be freely given in massive doses.

Nitrate of pilocarpine in one-sixth grain doses, repeated at the end of two hours if no perspiration ensues, has been used at the Pennsylvania Hospital with satisfactory results. It is not to be prescribed in cases where the heart is feeble and weak. In the exhibition of this drug especial care is to be exercised when prescribing it to negroes, as it is apt to produce in them exhaustive sweating.

Local Treatment.—The patient must be isolated, with an especial nurse in attendance. The inflamed part should always be kept cold and raised, air being excluded from the surface. Cold fomentations are the best, especially when medicated with poppy, hop, or chamomile. Tincture of iodine, sulphate of iron, a drachm to a pint of water, tincture of the perchloride of iron, muriated tincture of iron, a solution of the acetate of lead and opium, chloride of ammonium, alcohol, chloride of sodium, carbonate of potassium and quinine; a subcutaneous injection of a solution of carbolic acid; nitrate of silver in solution, say from twenty to thirty grains to the ounce of water, applied directly over the affected parts, are all, in turn, highly recommended.

In the more simple varieties of the disease, it is sometimes useful to grease the part with vaseline, afterward covering it with a rag wetted with opiated water or to dust with starch, flour, arrowroot, prepared chalk, or carbonate of zinc. Ichthyol gives good results.

Multiple encircling and radiating incisions may be of benefit in checking the spread; washing of the parts with ethereal soap and irrigation of any wounds or abscesses with bichloride of mercury, 1:2000 is useful. Painting a band of iodine around the margin of the involved area sometimes does good, likewise the use of Crede's ointment of soluble silver. Antistreptococci serum has apparently given a happy result in some cases.

In the *cellulo-cutaneous* forms of the disease, as soon as tension of the integument appears, incisions must be made deep enough to allow of the escape of the serum from the cellular tissue beneath and to relieve the tension. Some surgeons recommend that the incisions be free, so as to extend the whole length of the affected parts; others prefer a greater number of limited incisions; preference is given to the latter method. The long incisions are attended with copious hemorrhage and great risk of life, while the hemorrhage from the limited incisions can generally be controlled by elevation of the part and pressure, applying the usual antiseptic dressings.

SHOCK, OR COLLAPSE.

Shock, Prostration or **Collapse,** are terms used to signify the loss of power which immediately follows severe injuries, especially those attended with violence. It is due to reflex paralysis of the vasomotor system of nerves.

Shock may be caused by any severe injury, especially gunshot wounds, compound fractures, severe burns, protracted surgical operations, and all cases in which serious injury is attended with violence, pain, and loss of blood. Mental shocks may be as severe and fatal as those of the body. Sometimes shock is so severe that the patient sinks from it without reaction; this is especially likely in injuries of the vital organs or of the abdominal viscera.

Treatment.—The patient must be kept in a horizontal position; all constricting clothing must be removed; free access to the cold air must be provided; cold water should be dashed into his face; a bottle containing dilute aqua ammonia should be held under the nostrils. If the case is unusually severe, atropia, or tincture of digitalis, or whisky, should be injected under the skin; stimulating injections should be thrown into the rectum. Hot brandy and water, if the patient can swallow it, is probably more efficient than anything else; a few drops of aqua ammonia may be added. An enema of hot water, to which has been added from two to four teaspoons of turpentine to a quart of water, is frequently of great service. A hypodermic injection of morphia, gr. ¼, is highly recommended to promote respiration. In severe and protracted cases certain symptoms present themselves that demand attention: *vomiting;* the remedies for which are iced soda water, with or without brandy; powdered ice introduced into the mouth and allowed to melt; effervescing draughts; sinapism to the epigastrium; creasote in small doses. *Hiccough* is relieved by the same remedies. Hoffman's anodyne, or chloroform, a few drops on ice, will often prove serviceable. Bleeding, if any exist, must, of course, be checked. Saline infusion and hypodermoclysis plus external heat are always to be relied upon. The infusion should be given as a prophylactic and never wait until extreme shock is present before giving it. Artificial respiration should be carried out when necessary.

TETANUS.

Tetanus is a more or less violent and extensive contraction of the muscles of voluntary motion, attended with rigidity and tension of the parts affected; due to the bacillus of tetanus.

It begins, generally, with the muscles of the jaw. When it is confined to this part of the body, it is called *locked jaw.* When all the body is affected, and becomes rigid, but retains its ordinary straightness, the case is one of *tetanus;* when the head is stretched backward, it is called *opisthotonos;* when the body is bent forward, it is called *emprosthotonos;* when the tension is confined to the muscles of one side, it is denominated *pleurosthotonos;* when tension causes straightening of the body it is called *orthotonos.*

Tetanus derives its origin from the infliction of wounds, and it arises more particularly from wounds of the extremities; it is produced, most commonly, in consequence of contused, lacerated, or punctured wounds. It may occur in all stages of a wound; it usually comes on some days after the occurrence of the injury. Powder, gunshot and the fourth of July wounds, made by toy pistols, are very apt to be followed by tetanus, unless carefully treated. The acute tetanus generally develops in from three to five days after the injury, but may come on as late as the tenth day. Tetanus developing after the tenth day of injury is spoken of as chronic and possesses a much lower mortality than the acute. The shorter the incubation period the more virulent the infection.

Symptoms.—The patient finds a stiffness in the movement of the jaw; he experiences an uneasiness in swallowing, and he soon perceives that he has a difficulty in separating his teeth for the admission of food. He begins, now, to feel a pain behind the sternum, and this pain extends from the pit of the stomach toward the vertebral column. The muscles of the back, and of the neck and back, begin to be affected by spasms, then those of the abdomen, afterward those of the limbs, and lastly those of the face.

The muscles become more and more rigid as the case progresses. In the extreme period of the disorder all the muscles of voluntary motion are affected; among others those of the face; the forehead and nose are drawn up; the eyes are distorted, fixed, and motionless; cheeks retracted, and the features undergo an extraordinary change. The spasms become universal, and a violent convulsion puts an end to the misery of the patient.

Prognosis.—In the acute form very grave; in the chronic form favorable.

Treatment.—The indications are to husband the strength of the patient till the disease shall cease; to remove, as far as practicable, all conditions believed to have the power of creating the tetanic state, and to employ any sedative or special treatment from which we may hope to derive advantage. A wound should always be searched for and found, opened, thoroughly curetted and cauterized, or better still all infected or probably infected areas cut away. Tetanus antitoxin should be generously used early in the case.

The chief thing to be attended to is perfect quiet; the room should be kept dark, and the patient kept, as nearly as may be, in perfect repose; remedies should be administered as gently as possible; everything harsh or violent should be avoided. If nourishment cannot be swallowed, it should be administered *per anum;* it should be as plentiful as the nature of the case will admit; the supply of brandy and wine should be abundant. Quinine and iron should be freely administered; opium and morphia have, in many cases, been serviceable; chloral hydrate, chloroform, Indian hemp, and tobacco have all been tried, in turn, and sometimes with success. Hydrobromate of hyoscine has recently been highly recommended in the treatment of convulsions.

Surgeons place their main dependence upon large doses of bromide of potash and chloral. Should suffocation be threatened from spasm of the glottis, inhalations of nitrite of amyl should be resorted to: the usual quantity administered is from five to ten minims. A cardinal rule to be always followed in the treatment of wounds caused by fireworks and toy pistols is to give at once a protective dose of anti-tetanic serum when the case is first seen.

INJURIES OF THE HEAD.

Wounds of the Scalp.—These must not be neglected, however slight; they may be followed by erysipelas, inflammation, and suppuration. All wounds should be quickly closed; the scalp should be shaved for some distance around the wound; care should be taken to wash away all foreign bodies and *clots* with bichloride of mercury solution and a syringe. No part of the scalp, however torn, should be cut away. Careful coaptation must be made by means of sutures. If the injury be extensive and has possibly become infected, the safest plan is to resort to drainage. The patient should be confined to bed, or to the house, purged, and put on a milk diet.

Hemorrhage from small vessels is usually controlled by closing the wound and using pressure; larger vessels must be secured.

Every scalp wound should be carefully examined with the finger and probe, so as to ascertain whether or not fracture of the skull exist. Always make sure that fracture by *contra coup* is not present.

If *suppuration* occur, indicated by rigors, chills, dry tongue, with increase of swelling and throbbing pain, the adhesions must be separated at any suspicious spot and free drainage established.

If there be *suppuration under the scalp*, counter openings should be freely made, drainage established, and then dressed antiseptically.

If there be *serous effusion*, it may be necessary to let it out by one or two punctures.

CRANIO-CEREBRAL TOPOGRAPHY.

Rules for the location of various points.*

The Glabella is the small space between the eyebrows, and immediately above the line from one to the other.

The Inion is the external occipital protuberance.

The Median Fissure is represented by a line drawn from the glabella to the inion.

The Fissure of Bichat is between the cerebrum and the cerebellum; its position is ascertained by a line drawn from the inion to the external auditory meatus.

The Fissure of Rolando commences at half an inch behind the midpoint between the glabella and the inion; it is three and three-eighths inches long and forms an angle with the median line of 67.5°.

Horsley's Cyrtometer is used to determine the fissure of Rolando. It consists of an instrument made of metal or two strips of parchment paper, the antero-posterior arm being 14 inches long and the lateral arm being placed at an angle of 67.5°. The scale starts from zero, half an inch in front of the lateral arm, and runs forward and backward. To determine the fissure of Rolando, place the antero-posterior arm in the middle line in such a position that the glabella and the inion will each mark the same distance from the zero point to the scale. The lateral arm will then correspond to the fissure of Rolando.

The Fissure of Sylvius is determined by a line drawn from the external angular process to the occipital protuberance; on this line take a point one and one-eighth inches posterior to the external angular process; a line drawn from this point to the parietal eminence will represent the posterior branch of the fissure. The anterior limb corresponds to the squamoso-sphenoidal suture.

Reid's base line is from the lower border of the orbit through the center point of the bony meatus of the ear.

To Locate the Middle Meningeal Artery and its anterior branch, trephine one inch and a quarter back of the external angular process, on a level with the upper border of the orbit. The posterior branch will be found by trephining on a level with the same opening just below the parietal boss. The lateral sinus may be located by a line drawn from the external occipital protuberance horizontally outward and ending at a point one inch posterior and on a level with the external auditory meatus. A second line dropped from this point to the middle of the mastoid process represents its descending portion.

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* Condensed from "American Text-Book of Surgery."

To Tap the Lateral Ventricle, a trephine opening should be made one and a quarter inches behind the external auditory meatus and the same distance above Reid's base line; a grooved director, or a small French catheter (No. 5), should be thrust carefully into the brain in a vertical direction to a point two and a half inches above the opposite meatus; if the ventricles are not distended, they will be reached at a depth of two and a quarter inches, but if dilated they will be found at a less depth.

In order to reach the Antrum, in a case of Abscess of the Middle Ear, an opening should be made from one-third to one-half an inch behind and above the center of the meatus, or within Macewen's triangle.

Macewen's Triangle.—The supra-meatal triangle is bounded by the posterior root of the zygoma, the posterior wall of the bony meatus and a line joining the two.

Abscess of the Temporo-sphenoidal Lobe.—The trephine should be placed at a point one and one-fourth inches above and one and one-fourth inches behind the middle of the external auditory meatus (Barker's point).

The upper third of the convolution which is situated in front of and behind the fissure of Rolando corresponds with the center for movement in the leg; the middle third of the convolution is the center for the movement for the arm; this third is subdivided into three parts: the upper part is for the center for movement of the shoulder; the middle controls the movement of the elbow, and the lower portion that of the hand. In the last third of the convolution is situated the face center. Vision is chiefly located in the cuneus (occipital lobe).

Pressure on the Broca convolution will produce motor aphasia; on the lower portion of the Rolandic motor region it will cause paralysis of the opposite side of the face; as it extends upward in the motor region paralysis of the arm will ensue, followed by paralysis of the leg. The frontal and occipital lobes of the brain being latent areas, no localizing symptoms will follow from pressure, unless the cuneus should be involved, when hemianopsia of the same half of each retina will follow. Pressure on the angular or supra-marginal gyrus is apt to produce monocular Argyll-Robertson's pupil.

CONCUSSION OF THE BRAIN.

Concussion is a sudden interruption of the functions of the brain, caused by a blow or other mechanical injury of the head. Many surgeons consider this condition synonymous with laceration of the substance of the brain.

Symptoms.—In ordinary cases the patient lies for a time motionless, unconscious, and partially insensible; the pupils are more or less contracted and the patient turns away irritably from the light; if roused and questioned, he answers hastily and again relapses into apparent insensibility; after a time he moves his limbs as if in an uneasy sleep, vomits, and frequently recovers immediately afterward; remaining, however, giddy and confused for some hours.

In the more severe cases the patient is profoundly insensible, the surface and extremities are pale and cold, and the features ghastly; the temperature at first is subnormal, the pupils are sluggish and sometimes dilated, but equal on both sides, unless the brain is injured; the pulse is quick, feeble, and intermittent, or hardly to be felt, and the breathing slow, or performed only by a feeble sigh drawn at intervals.

Vomiting is an important symptom. Its presence is generally an indication of approaching reaction and recovery. As reaction goes on, the pulse at first quickens, becomes stronger and slower, the carotids throb perceptibly; there are black spots and flashes of light in the eyes and noises in the ears; pain in the head is felt and increases; the eyes are suffused and the face flushed.

If the concussion be very severe it may be followed by immediate death.

Concussion is occasionally succeeded by a peculiar state of insensibility which may last some days. The patient lies as if in a tranquil sleep; his pulse is regular, but on the slightest exertion it rises to 130 or 140; when roused he answers questions, but immediately relapses into unconsciousness.

Treatment.—To recover the patient from insensibility and collapse, apply friction to the surface with the hand and warm applications to the feet; mustard plasters to the calves of the legs.

Stimulants, if used, must be employed with the greatest caution, so that reaction may not be too violent. Alcohol should not be used.

After reaction has taken place, the bowels should be acted on; quiet in a dark room, with rest and low diet, should be observed.

If the pulse becomes hard and frequent, and if the patient complains of pain, throbbing, or tightness in the head, or if he becomes flushed or delirious, or stupid and comatose, or if vomiting returns, blood should be taken from the arm, or by leeches from the head, and purgatives should be administered. Twenty grains of bromide of sodium should be given every four hours. The head should be kept cool. The patient should observe a cautious diet and remain free from excitement or fatigue for some time after the occurrence of the injury.

The consequences of concussion are persistent headache, deafness, giddiness, squinting, loss of memory, tinnitus aurium, etc.; for these a mild course of mercury may be necessary with iodide of potassium, together with repeated blisters, change of air, etc. Should symptoms of hemorrhage or infection of the brain ensue the patient should be trephined.

COMPRESSION OF THE BRAIN.

Compression may be produced by extravasation of blood, effusion of serum, fracture of the skull with depression, suppuration within its cavity, and by pressure produced by tumors or foreign bodies.

The symptoms are those of apoplexy. Insensibility, palsy, dilated and insensible pupil; slow, laboring pulse; skin often hot and perspiring; retention of the urine, through palsy of the bladder; involuntary discharge of fæces, through palsy of the *sphincter ani;* stertorous breathing, owing to palsy of the *velum pendulum palati; whiffing* or *puffing* respiration, from palsy of the buccinator and other facial muscles. The palsy, if it exists, will vary greatly in degree; if it be on one side, it will be opposite to the injury of the head. There may be convulsions, muscular twitchings, or rigidity.

The symptoms of compression by extravasation generally show themselves by the patient becoming stunned and insensible, from the concussion, with feeble pulse and cold skin. After awhile he recovers his senses, more or less perfectly, but again, in an hour or two, becomes sleepy, confused, and insensible, with slow, stertorous breathing, slow pulse, and dilated pupils.

Diagnosis.—In concussion, the symptoms follow the accident immediately; those of compression from effusion of blood *may* come on after an interval. In concussion, the pulse is feeble, irregular, or intermittent, the skin pale, and the respiration sighing and weak; in compression, when reaction is thoroughly established, the pulse will be slow and full, and the skin hot and perspiring.

In concussion, stertorous breathing and palsy are rare; in compression they are common.

In concussion the pupil is variable; sometimes contracted and sometimes dilated; in compression it is almost always dilated and insensible; frequently unequal on the two sides.

A differential diagnosis is very difficult between coma, the result of an injury, and that produced by opium, alcoholic intoxication, apoplexy, or uremia.

In opium poisoning there is a fixed, contracted condition of the pupil, slow, shallow respiration, and no paralysis. *In alcoholic coma* there is the general appearance of the individual; the pupil contracted to a pin's point, which slowly dilates when there is an attempt made to arouse him; the odor of the breath; and as a rule the ability to arouse the patient by hitting smart blows upon the soles of the feet. If there is doubt, the urine should be drawn and examined for alcohol. *In apoplexy* there is stertor, accompanied by a peculiar puffing in and out of the cheeks; the pulse is full and strong; the pupils fixed and dilated; or one may be dilated and the other contracted. *In uremia* the coma is not continuous; the breathing is quiet, not stertorous; there is no paralysis. There is usually œdema of the legs. The urine should be examined for albumin.

The treatment depends upon the cause of injury. Shave the head and examine carefully. If the compression be produced by fracture of the skull, treat it as directed under the subject of fracture of the skull; if the symptoms indicate that there is hemorrhage present, trephine, remove the clot and secure the bleeding vessel; if the pressure be due to pus, the abscess should be evacuated and drained; if there should be a foreign body or tumor present, it should be removed if it be a proper case for an operation; if there be effusion into the lateral ventricles, they should be tapped and drained.

FRACTURES OF THE SKULL.

These are caused by great violence, such as blows or falls on the head and gunshot wounds.

The ordinary type of **symptoms** and consequences of fractures of the skull depend on the conditions which accompany them, especially the amount of concussion; the forcing in of portions of the bone; the complication with scalp wounds; the situation and the inflammation excited.

Simple fracture with depression may be ascertained by examination of the shaved scalp; there will be a depression at one part, with a corresponding edge or projecting ridge around it.

Treatment.—In a case of simple depressed fracture, if there be no symptom of compression, and if the patient is conscious and rational, he should be kept on the strictest regimen; lying down, head raised, cold water to head, and aperients are the remedies.

Trephining is recommended in all cases of fracture with depression, whether symptoms call for it or not; under the belief that such sequelæ as epilepsy, fatuity, and softening of the brain may thus be avoided.

If **comminuted,** and it is probable splinters are sticking into the brain or its membranes, the bone must be elevated. If possible, it should be with the elevator alone.

Fracture of the Inner Table.—The inner table may be extensively splintered by injuries which perforate or slice through the outer table; such as cuts from sabres and blows with heavy weights. If, after careful examination, it is found that depression exists, the trephine should be used to raise or remove splinters.

Fractures of the base of the skull may run in various directions; they are most frequently found passing through the petrous, squamous, and sphenoid bones.

The **diagnosis** will be founded on the nature of the injury; the patient will probably be injured from having been pitched on his head; there will probably be bleeding from one ear; after the bleeding has ceased a most significant symptom is the draining through the ear of a clear fluid (cerebro-spinal fluid); symptoms indicating damage to the nerves that escape from the base of the skull may be noticed; bleeding from the nose and mouth will show the direction of the fracture; as a rule, if the fracture is of the anterior fossa the hemorrhage will be from the nose; if of the middle fossa, it will be from the ear; if of the posterior fossa, it may find its way into the pharynx, from thence into the stomach, and ultimately be vomited up. Hence care must be taken not to be misled and suppose that the stomach is involved in the injury.

Symptoms and prognosis depend on the amount of injury to the brain; stupor, dilated and unequal pupils, with rapid pulse, hot skin and dry tongue, and delirium are unfavorable symptoms.

Treatment.—Absolute repose, low diet, giving the patient a purge, ice or cold water to the head, and the bromides are the remedies.

If the fracture involves the middle ear, the external ear should be cleaned carefully, rendered antiseptic, insufflated with iodoform, and packed lightly with sterile gauze or cotton. Should the fracture communicate with the nose or mouth, these cavities should be sprayed with warm sterile or peroxide of hydrogen water, a weak solution of boracic acid and the nose plugged with iodoform or bichloride gauze.

Rules for Trephining.

1. In simple fracture without depression, or evidence of compression, do not interfere; if symptoms develop, trephine.
2. In simple depressed fractures, without symptoms of compression, trephine.
3. In simple depressed fractures, with symptoms of compression, trephine.
4. In small, compound fissured fractures, without symptoms of compression, chisel a portion of the bone away on each side of the fissure for its entire length.
5. In compound depressed fractures remove the splinters, trephine, and elevate.
6. In punotured fractures, trephine.

Trephining.—The whole head must be shaved and a flap cut over the point of operation, horseshoe in shape, three inches in diameter, with its base, as a rule, downward, should be raised. The surgeon applies the trephine, which should be one and a half inches in diameter, with the point of his forefinger protecting the crown, and working it with an alternate pronation and supination of the wrist; and when it has made a circular groove deep enough to work it steadily, he must take care to withdraw the center pin. He must saw steadily and cautiously, frequently examining the groove to ascertain whether he has reached the dura mater, and when he has done so he introduces the broad curved forceps to raise the circular piece of bone. The greatest care must be taken to fix the center pin and the greater part of the circumference of the instrument on firm bone, and by no means press heavily while sawing on any piece of bone that is loose or yielding. When the saw reaches the diploë there will be an escape of blood with the bone dust, but there is but little diploë in children or the aged.

When the piece of bone is removed the surgeon must gently insinuate the point of the elevator under that which is driven in, and using his finger, or the edge of the firm bone, as a fulcrum, slowly raise it to its proper level. All loose fragments having been removed and the wound sponged, the scalp must be carefully laid down.

It is frequently necessary to open the dura mater. This is accomplished by seizing the membrane with a pair of rat-tooth forceps, drawing it away from the brain, making a puncture with the point of the operating knife, when a semilunar incision is made with a pair of probe-pointed curved scissors. Before closing the wound the free edges of the dura mater are to be brought together by a continuous catgut suture. When the button of bone is to be replaced, it should be put in a bowl containing normal salt solution; the bowl to rest in a basin containing water at a temperature of 110° F., and kept there during the operation. The last steps of the operation are to close the wound in the scalp with interrupted silkworm-gut sutures. Drainage is not to be employed unless the operation is performed for the purpose of draining an abscess; or unless the operator fears exudation of blood or serum.

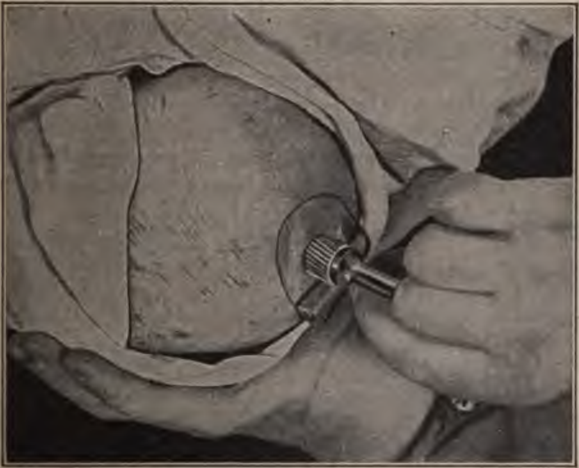


FIG. 22.—Application of Trephine and Showing Flap. (*Binnie.*)

When it becomes necessary to make a large flap to remove a tumor or foreign body from the brain the osteoplastic trephine of Stellwagen may be used or the mallet and chisel.

INTRACRANIAL HEMORRHAGE.

Intracranial hemorrhage from injury may take place in three positions: between the dura mater and the bones, when it is known as extra-dural; between the dura mater and brain, when it is designated as sub-dural; in the brain itself, when it is called cerebral.

Extra dural hemorrhage is the condition most frequently encountered; it is due to the rupture of the middle meningeal artery or one of its branches.

In all these cases the patient is stunned by the effects of the injury; there is a brief period of unconsciousness, from which he recovers to again relapse. The period of consciousness followed by coma is most important; it is due to the intracranial hemorrhage taking place with more or less rapidity. Associated with the unconsciousness there is progressive paralysis. The pulse becomes frequent; respiration slow and stertorous; the temperature will rise from normal to 103° F. or 104° F. If the clot extend toward the base of the brain, the pupil upon the side where the extravasation takes place will be dilated and immovable.

The position of the clot is to be determined by the symptoms; when this is done, the patient is to be trephined at the site, the clot removed, and, if necessary, the vessel ligated. If after trephining over the middle meningeal artery it be found uninjured, the instrument should at once be applied over the posterior branch of that artery; if the wounded vessel is discovered it should be secured, the wound closed, and treated in the usual manner. If the artery cannot be located the hemorrhage should be controlled by packing with iodoform gauze.

ABSCESS OF THE BRAIN.

This may be produced by blows or injuries such as compound fractures, or by a splinter being broken off from the inner table of the skull and driven into the brain. It may occur from pyæmia, septic disease of the lungs, or ulcerative endocarditis. Most commonly it is the result of suppuration of the middle ear.

Symptoms.—The most important and constant symptom is marked headache. The pulse is slow and full; the respiration is usually of the Cheyne-Stokes type; in some cases there is choked disk; the temperature as a rule is normal; chill is often absent, but occasionally present at the outset; epileptoid convulsions often occur; usually there are anorexia, vomiting, and general malaise; the bowels and bladder are evacuated involuntarily.

Treatment.—The abscess should be localized, the skull trephined, the abscess evacuated, and the wound drained.

Abscess following suppurative disease of the ear generally succeeds a chronic discharge and is usually situated in the temporo-sphenoidal lobe. As a rule there is a sudden cessation of the discharge, and at the same time nausea, vomiting, rise in temperature with pain in the mastoid region or neck, together with headache, that may be situated either in the frontal or temporal region. The tongue is dry and coated; there is diarrhœa; pulse is frequent; the temperature is subnormal; mind clouded, mental hebetude, passing into coma.

The skull should be trephined, the abscess opened, contents evacuated, and the wound treated antiseptically and drained.

MICROCEPHALUS.

This is a condition where a child is born with the skull completely ossified, or where ossification has taken place soon after birth.

The operation for the relief of microcephalus is known as *linear craniotomy:* it is performed by making a longitudinal incision through the skin to one side of the sagittal suture, from the occipital bone to the hair line in front, and a transverse incision from the hair line downward. The flap is to be reflected back and a small opening made in the skull by means of a trephine; then with Keen's Rougeur Forceps a groove is cut as far forward as the angle of the wound in front; from this point a lateral groove is made. The parts are then irrigated, all hemorrhage controlled, and the flaps brought together by means of interrupted silkworm-gut sutures. In from six to twelve months a similar operation should be performed on the other side of the sagittal suture. Keen and La Place have done this operation for relief of microcephalus but with little improvement of the trouble.

GONORRHŒA.

Gonorrhœa is a contagious purulent inflammation of the mucous membrane of the genitals of both sexes due to gonococcus.

There are two varieties of gonorrhœa—the specific and non-specific. **The specific** is produced by microörganisms called gonococci; the **non-specific variety** follows intercourse during the menstrual period, or when the female is suffering with leucorrhœa. It may also occur in persons affected with stricture, hypertrophied prostate, gouty diathesis, etc., etc.

The symptoms of each form are much alike; the non-specific variety has a tendency to run a short course, the patient convalescing in from ten days to three weeks. In rare cases it is as obstinate as in the specific form.

The time at which the disease usually appears after contagion is from twenty-four hours to ten days, usually from three to five days; the later it appears the less severe it generally is.

The patient first experiences a sense of titillation in the urethra, as if a drop of urine were contained in it. Upon examination, he finds that the lips of the urethra are red and pouting, and that there is a slight mucous discharge. Soon the urethra begins to be affected with considerable heat, and pain is experienced in voiding the urine, which is called *ardor urinæ*. The pain in many cases becomes excessively severe; there is an appearance of threads mixed with the urine. The next effect is a considerable diminution in the size of the stream of urine, the swollen state of the urethra contracting the calibre of the canal; it is often discharged in two or more streams, becomes forked, in consequence of the irregular and contracted state of the urethra, and is passed with much straining, pain, and scalding. At first the discharge is mucous, but after a little time it assumes a purulent appearance. The matter becomes yellow, and in some cases green, and is frequently mixed with blood, so as to give the discharge a sanious appearance.

The disease does not confine itself to the beginning of the urethra, but extends along the course of the canal, and often produces inflammation of the glans and frænum, occasioning effusion into the prepuce and phimosis. The lymphatic vessels on the dorsum penis often become enlarged and hard, producing little abscesses.

In a first gonorrhœa the glands of the groin are often sympathetically affected, and become enlarged and painful; these may break down and suppurate, producing a bubo.

Irritation and inflammation also take place in the corpus spongiosum, producing the painful state known as *chordee*. The penis is sometimes curved, and sometimes turned considerably to one side, and the groins, thighs, perineum, and testicles ache and feel tender.

After the inflammatory stage abates, a muco-purulent discharge remains, which, when obstinate and thin, is called *gleet*.

In the inflammatory stage of the disease there is often *irritation* or *actual inflammation of the urinary organs*, causing the most exquisite agony, or complete retention of urine. This inflammation may reach the bladder, giving the patient a desire to frequently pass water, and causing great pain in doing so.

There may be *hemorrhage* from the urethra; inflammation of the lymphatic glands of the groin, constituting bubo; *balanitis,* or suppurating inflammation involving the glans penis; phimosis, paraphimosis, or inflammation of the testicle in men or the ovary in women.

Treatment.—The treatment should begin with a free use of a mild sedative injection into the urethra. The bowels should be opened by some saline aperient. Abstinence from all alcoholic liquors should be enjoined; the diet should be very plain, and sleep should be procured by Dover's powder or other anodynes to guard against constipation.

The oleoresins of cubebs and copaiba should be administered when the case first presents itself. They should be given in doses of ten minims each three times daily; salol, fifteen grains, should be added to each dose. The oil of sandalwood also has a high reputation, but is best employed in the subacute and chronic stages. Urotropin and methylene blue given in the early stages lessen the severity of the attack.

The usual mode of administering copaiba is in the form of a capsule containing cubebs, copaiba and salol or sandalwood oil. Painful erections and chordee may be relieved by an ice bag applied to the part; or a little mercurial ointment and extract of belladonna may be smeared on the parts at bedtime, together with the free administration of the bromides, say from 20 to 60 grains, or of morphia in ¼ grain doses. A treatment sometimes of use is the injection of a four per cent. solution of cocaine, to be retained in the urethra from three to five minutes. Hemorrhage may be checked by cold water and ice pressure on the urethra at bedtime.

ORCHITIS.

Acute orchitis, or acute inflammation of the testicle, may be caused by local violence, cold, wet, epididymitis, rheumatism, gout and mumps; it generally occurs in conjunction with gonorrhœa, and is liable to be induced by employing injections and at the same time neglecting to use a suspensory bandage.

SPECIAL FORMS, SYPHILITIC AND TUBERCULAR.

Symptoms.—If the patient is suffering from gonorrhœa the discharge will cease, and he will complain of aching pains in the testes and cord, followed by tenderness, swelling, fever, and frequently by nausea and vomiting. The part first and chiefly affected is the epididymis. The swelling arises mainly from an effusion of lymph and serum into the tunica vaginalis.

The symptoms of epididymitis closely resemble those of orchitis; in the latter the constitutional disturbance is greater, the local pain much more intense, and the patient does not assume the erect posture, but walks best with his legs apart. In orchitis the testicle is felt to be enlarged, globular, extremely sensitive, and tender. When the epididymis is inflamed it will be found above and behind the testicle, lying like a thick semilunar mass, threatening to overlap the testicle above, below, and at the sides.

Treatment.—Absolute rest in the recumbent posture; leeches over the cord, and opium at night, to allay pain. Purgatives, warm fomentations, and a suspensory bandage, to elevate the parts on the abdomen. The ice bag and applications of lead water and laudanum are often useful in the earlier stages of the disease.

If injections are being employed they must be discontinued. When the swelling subsides and the discharge returns put the patient on the use of the oil of sandal wood and bromide of soda.

Punctures of the tunica vaginalis testes, with a tenotome, will frequently give immediate relief by evacuating the fluid.

When the acute stage has subsided, strapping, by the application of adhesive strips, should be employed. An ointment containing ichthyol, belladonna and mercury greatly aids in resolution.

Chronic orchitis may succeed an acute attack or it may arise spontaneously. The exciting causes are chronic cystitis, hypertrophy of the prostate gland, stricture, and gonorrhœa.

If the exciting cause is still in operation it must, of course, be removed; the patient should be confined to his back and put on the use of iodide of potassium; if this does not answer he should be mercurialized, using for the purpose protiodide of mercury.

Tuberculous Orchitis.—This may be primary but usually is secondary to tuberculosis of the bladder, seminal vesicles or prostate. Tuberculosis of any portion of the body may be succeeded by tuberculous orchitis. The infection, as a rule, begins in the epididymis and later involves the testicle. If seen at this time an epididymectomy may be performed and the testicle saved. In most cases there is a history of gonorrhœa. Injuries and inflammations are very apt to be followed by tuberculous epididymitis and orchitis. The scrotum in the later stages is red, swollen, and the skin adherent. The process may ulcerate through exposing a caseating mass.

Treatment.—Secure rest, forced feeding, change of climate (preferably that of southern California). Life in the open air. The administration of creosote internally and the use of an intervesicle instillation of creosote are most useful. Should the above fail, operate the sooner the better. At the time of operation if the skin of the scrotum is involved it should be freely cut away, for if allowed to remain reinfection will ensue. It is the belief of the author that tuberculosis of the genito-urinary tract is a more common condition than generally accepted.

ACUTE PROSTATITIS.

Acute prostatitis is generally a consequence of acute gonorrhœa, but may be caused by stricture, impacted calculus, the passage of sounds or catheters, lithotrity, sexual excesses, or masturbation.

The **symptoms** depend upon the severity of the attack; there is a sense of weight, pain, and throbbing at the neck of the bladder, hardness and tenderness of the perineum; the gland feels swollen and tender on examination per rectum. There are frequent, violent, and painful efforts to make water. The stream is small and ejected without force; if the swelling and congestion become worse the urine will stop altogether. As the disease subsides a grayish, viscid, muco-purulent matter is voided with the urine and at defecation.

The anxiety, distress, and fever rapidly increase as the disease progresses; there is tenesmus and constant sense of fullness of the rectum; the prostate can be felt projecting into it, which, hard and firm in the early stages, becomes soft and fluctuating if an abscess is formed.

The symptoms may subside gradually; the hardness and tenderness slowly disappearing, or the inflammation may become chronic, or suppuration may set in. The abscess may open into the urethra, the perineum, rectum; or large chronic abscesses may form in the region of the prostate.

Treatment.—Place the patient in a hot bath and keep him in it until he begins to feel faint, giving him at the same time thirty or forty drops of laudanum. The opium suppository is to be used when necessary. If relief is not obtained by this means, draw off the urine with a small flexible catheter. Apply leeches to the perineum, and then fomentations, or opiated poultices; administer an enema of starch, two ounces, laudanum, half a drachm, every night. Keep the patient in bed. If suppuration ensue, cut down through the perineum and drain the abscess.

CYSTITIS.

Cystitis inflammation of the bladder may be acute, chronic or tuberculous. The disease is, as a rule, a complication of some other genito-urinary lesion; it may however arise from injury and exposure to cold and wet after an alcoholic debauch. Neglected or ill-treated gonorrhœa, gout, stone in the bladder, stricture or disease of the prostate are all potent causes of cystitis.

The symptoms are pain in the perineum, groin or sacrum. Usually there is pain and tenderness over the lower part of the abdomen, and a constant desire to urinate, with the passage of a small amount of urine containing mucus or muco-purulent material and if the case be one of long standing, a decidedly ammoniacal odor. In severe cases ulceration, sloughing, and the formation of false membranes may occur. The chronic form is always associated with marked infection and an ammoniacal urine. The bacillus typhosus, coli communis, tuberculosis and the gonococcus are the organisms commonly productive of cystitis.

In chronic cystitis the bladder wall becomes greatly thickened and the viscus contracted so that it holds but a few ounces (interstitial).

Treatment.—Always endeavor to remove the cause. If this be stricture it should be dilated. Enlargement of the prostate, often the cause of a chronic cystitis, may be relieved by one of several operations.

If the inflammation is acute and septic, put the patient to bed and apply external heat to the abdomen and perineum. Hot hip baths and the use of enemata are very beneficial. A simple diet should be insisted upon. The bladder should be washed out daily with a warm solution of boric acid or normal salt solution. Continuous catheterism is sometimes of use where the urine is irritating. The bladder should always be irrigated, morning and evening, in cases where the instrument is to remain. Internally the administration of remedies to render the urine bland and sterile are proper. Salol, urotropin, ammonium, benzoate, boric acid, quinine, benzoic acid and sandalwood oil are a few of the remedies used.

Symptoms of Chronic Cystitis.—Chronic cystitis may succeed the acute form or it may develop insidiously. Desire for urination is increased, but not so urgent as in the acute variety. The bladder wall becomes markedly thickened and the musculature very much over-developed from the irritation and a more constant desire for urination. There is a feeling of fullness in the rectum accompanied by pain and tenesmus. This may be reflected to the head of the penis or about the anus. In old men who do not have kidney complications—which, however, are rare—constitutional symptoms are usually absent. The sufferer from chronic cystitis usually passes large quantities of mucus. Stone and prostatic enlargement are often associated with this condition.

Tuberculous Cystitis.—Primary infection of the bladder is rare; vesical tuberculosis is usually secondary to an infection of the kidneys, ureters, seminal vesicles, prostate or epididymis. All forms of cystitis apparently of uncertain causative origin should have the urine carefully examined for the tubercle bacillus. This organism, however, may not be found and its absence does not preclude the diagnosis of tuberculous cystitis. When possible the cystoscope should be used and the bladder carefully examined for the presence of ulcerations. Tuberculous ulcers are as a rule located upon the trigone, close to the inner orifice of the urethra. The finding of grayish-white nodules is equally diagnostic as the presence of an ulcer.

Treatment.—Change of climate, forced feeding, the administration of creosote internally and in the form of instillations into the bladder in liquid cosmoline are very beneficial. The use of creosote instillations has given most encouraging results in the author's clinic, and is used in many cases of chronic cystitis, not of tuberculous origin. The urinary antiseptics before mentioned all have their advocates and undoubtedly are useful in some cases. Should the above measures fail and the patient's health be waning with increased urinary infection it behooves the surgeon to establish either supra-pubic or perineal vesical drainage.

STRICTURE.

Permanent **stricture** is caused by contraction of the urethra, usually from inflammation, infiltration of plastic effusion, and subsequent shrinking of this material and of the canal, with fibroid degeneration of the tissues around.

Strictures are classified as annular, linear, irritable, resilient, strictures of large and small calibre; permeable—that is, where an instrument can be passed through the stricture—and impermeable, where even the smallest instrument cannot be passed.

In some cases a small portion of the mucous membrane is found thickened and deprived of its natural elasticity, but in old, neglected cases the canal, with the *corpus spongiosum* around, will be converted into a thick, gristly mass, several inches in extent.

The most frequent *situation* of the stricture is a disputed point; most authorities place it at the bulbo-membranous junction.

The causes of stricture are repeated attacks of gonorrhœa, causing probably 50 per cent., intemperance, unhealthy condition of the urine, and masturbation, which particularly affects the anterior portion of the canal. In the author's opinion, based upon considerable experience, the long-continued morbid erections that accompany gonorrhœa may be potent sources of stricture.

Symptoms.—The patient finds that he wants to make water oftener than usual, with an uneasy sensation in the perineum after doing so; a few drops remain in the urethra and dribble from him after he has buttoned up.

Next he finds that the stream is smaller than hitherto, that it is forked or twisted, and that he requires a long time to pass his urine. Difficulty in starting the stream is also a common symptom.

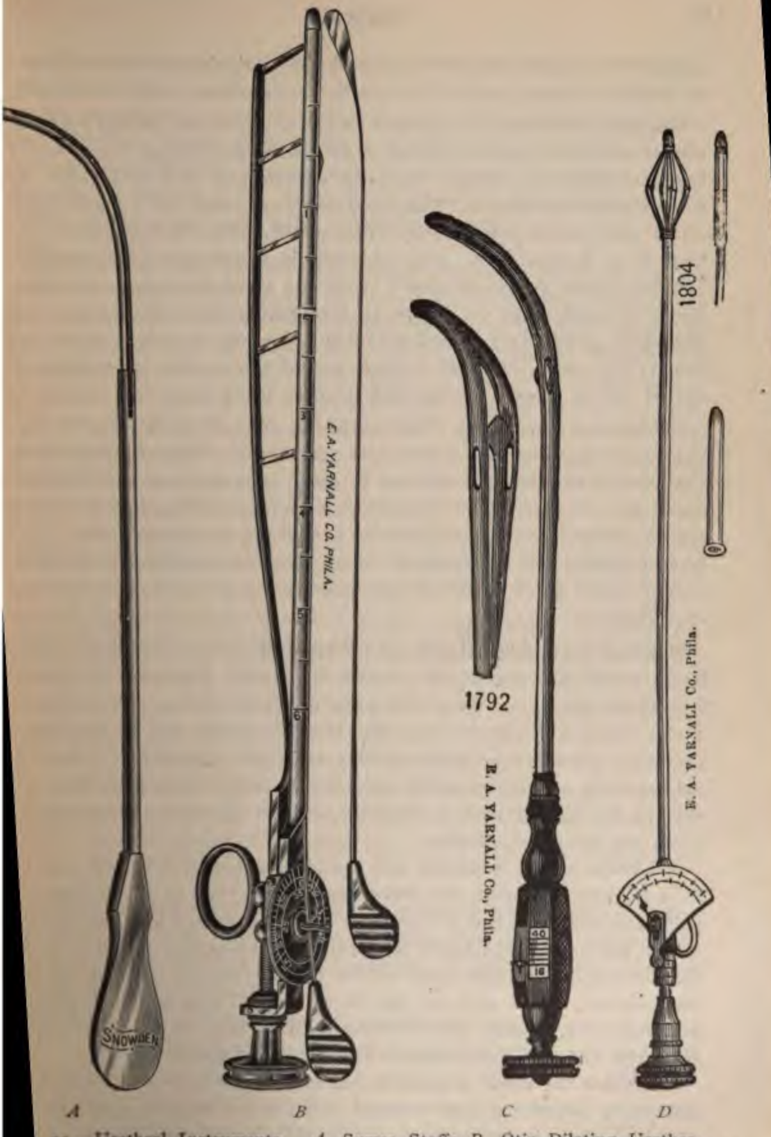
Pretty soon the bladder becomes irritable, so that the patient is forced to rise in the night to void his urine, and is liable to attacks of spasm, with complete retention. Very often there is a gleety discharge, frequently found in the morning on waking up.

If the complaint continues, the health suffers, the bladder, ureters, and kidneys become diseased. The patient suffers from general debility and nervous prostration, and the urine is loaded with fetid mucus. Going from bad to worse, the patient will finally succumb to irritative fever or uræmic poisoning.

Treatment.—When the case is taken in hand early, the general health should receive prompt attention, and any disorder of the stomach, inflammatory tendency, or irritating condition of the urine should be treated.

The *mechanical* means to be resorted to are: Gradual dilatation, continuous dilatation, rapid dilatation, modified rapid dilatation, internal urethrotomy, electrolysis, external urethrotomy, internal and external urethrotomy combined, and perineal section.

In order to determine whether the bladder or kidneys are diseased, and to decide the nature of the operation to be performed, the urine should be examined to ascertain the presence of albumen, pus, and the amount of urea present. Note should be made of the quantity of urine voided in twenty-four hours.



23.—Urethral Instruments. *A*, Symes Staff; *B*, Otis Dilating Urethrotome; *C*, Gross Dilator; *D*, Otis Urethrometer.

By means of the urethrometer and the exploratory bulbous bougie the number, position, and calibre of the strictures are to be established.

Gradual dilatation is employed in cases where the patient will not submit to a more radical operation, in recent cases before organization has taken place, in stricture of large calibre, and as a preliminary to other forms of treatment. The instruments employed are a conical steel sound and flexible silk bougies. This method relieves the patient, and may effect a permanent cure, provided it is continued long enough. The instrument employed should be passed every third day, care being taken to warm and oil it before introducing into the urethra. It should be gently passed and gradually increased in size as pain and hemorrhage abate, until the normal size of the urethra is reached. It should not be passed oftener than once in three days.

Continuous Dilatation.—This method is resorted to in cases of very tight stricture which will admit of the passage of a filiform bougie only. After being inserted and secured in place, it is allowed to remain for three days, at the end of which time a Thompson dilator, or a Goulay tunnel catheter can be passed over it and the stricture dilated. This method should not be employed where the patient suffers from retention of urine, which condition makes the case a proper one for external urethrotomy.

Modified rapid dilatation is best performed after the method pursued by Professor Brinton, which consists in properly preparing the patient by keeping him in bed three days prior to the operation, administering a gentle laxative so as to keep the bowels soluble, and giving him 5 grains of urotropin or other urinary antiseptic thrice daily. Let the patient have a light breakfast three hours before the operation. The urethra is irrigated with a saturated solution of boric acid, and he is given ten grains of quinine.

A filiform bougie is passed into the bladder and tied in place, where it is allowed to remain for three days, at the end of which time the patient is etherized, and a Thompson dilator is passed over the filiform to the site of the stricture; the operator now grasps the dilator and the filiform in the right hand, passes the instruments together through the stricture, which must be dilated to the full size of the Thompson instrument, 18, French, which having been withdrawn, the Gross dilator is passed, and the urethra slowly brought to its normal calibre.

After this the canal is washed out with a warm boracic solution; a catheter is introduced, and retained in place for three days, at the end of which time it is removed and a full-sized bougie passed, which procedure is continued every three days for several weeks. The method here laid down is applicable to all cases of stricture which are seated in the membranous portion of the urethra, where the patient is not suffering from disease of the kidneys, where there is no fistulous opening into the perineum, and where it is not due to traumatism. Both Professor Brinton and the writer have performed this operation many times, and in every case with complete success.

Dilating Internal Urethrotomy.—This method is applicable to all strictures situated within three and a half inches of the meatus. The same precautions are observed in preparing the patient as those recommended in modified rapid dilatation. Having located the position and ascertained the calibre of the stricture, the Otis dilator is passed until it engages the obstruction, then dilate until resistance is met with, when the concealed blade is made to divide the stricture on the floor of *the urethra.* Never over-dilate the canal with the Otis instrument, as this fault may cause the blade to cut too deeply and cause a permanent chordee. The urethrometer should be introduced to ascertain if the normal calibre of the urethra has been restored; if it has not, the urethrotome must be reinserted and the band further divided. The canal must be irrigated with normal salt or boracic acid solution, a catheter introduced, and allowed to remain three days. This operation cannot be performed if the stricture be under twenty millimeters; if the coarction is under this measurement, the calibre should be raised by means of a Maisonneuve's urethrotome up to 20 F., when the operation is to be completed by the Otis instrument.

Internal urethrotomy should not be performed in persons who are advanced in years, nor on those who suffer from an hemorrhagic diathesis or disease of the kidney. A bougie of the full size of the urethra must be passed every third day for at least one month after the operation.

External urethrotomy is advisable when there is a stricture so dense and unyielding, or so complicated with fistula, that internal urethrotomy cannot succeed, or where it is not possible to get a catheter into the bladder, from whatever cause.

In the first case Syme's staff is passed, and the stricture divided upon it. It is grooved on the convexity, and consists of two parts, of different diameters, which meet, with an abrupt shoulder, at the junction of the straight portion of the curve. The latter is the smaller of the two, so that it can pass through the contracted part of the urethra until it is brought to a standstill by the shoulder coming in contact with the face of the stricture.

The patient is placed in the lithotomy position, and a median incision made into the groove, taking care to divide thoroughly the whole length of the stricture. A probe is then introduced into the bladder to act as a guide, the staff withdrawn, and a catheter passed to make sure there is no further obstruction. When the wound is healing, bougies must be passed regularly. The new tissue that forms does not acquire the density of the old.

Internal and external perineal urethrotomy is resorted to when the patient is suffering from stricture of the pendulous portion of the urethra, together with an impassable stricture of the membranous portion of the canal. The patient must be prepared in the usual manner, and dilating internal urethrotomy performed on the anterior stricture, whilst the one that is deep seated is divided by the method described under the head of external urethrotomy. After the operation the canal and bladder should be thoroughly washed out with warm boracic acid solution, a catheter passed through the meatus and brought out of the wound into the perineum and passed into the bladder. At the same time a drainage is to be placed in the perineum. The drainage should be kept in place for four days, the canal and bladder being daily irrigated; at the expiration of this time the drain is removed and a full-sized bougie passed. This must be continued for six weeks.

Perineal Section (Cocks).—The urethra is laid open behind the stricture. The patient is placed in the lithotomy position, care being taken that he lies perfectly straight and the perineum is perpendicular. The operator sits in front, and with his left forefinger feels for the apex of the prostate. A long, straight knife, with its back toward the rectum, is then plunged steadily into the middle line underneath the bulb, so as to hit off the membranous part, or the apex of the prostate. A director is then passed into the bladder, and a soft catheter introduced and, if necessary, tied in. A preferable method is to make a careful dissection down to the urethra, open the canal and divide the stricture.

Electrolysis.—By this method an attempt is made to cure the stricture by means of electricity. For this purpose an urethral electrode is brought into immediate contact with the stricture. If any good is derived from this mode of treatment it is due to the continual dilatation produced by the electrode. This operation is frequently followed by such complications as urethritis, prostatitis, epididymitis, and affections of the bladder.

After giving electrolysis a fair trial, the writer is of the opinion that it should not be employed.

RETENTION OF URINE.

Retention of urine is an inability, whether partial or total, of expelling by the natural efforts the urine contained in the bladder.

Retention of urine may be due to causes acting on the urethra or the bladder. Calculus or other foreign bodies may become impacted in the urethra, tumors may press upon it, alterations in the walls of the urethra, either permanent, as stricture or enlarged prostate; or temporary, as congestion or spasm, may take place, or the bladder itself may be unable to expel its contents, from various causes, such as atony of its walls, paralysis, hysteria, disease of the spinal cord, peritonitis, exhaustion, alcoholic or other excesses, and shock.

Symptoms.—There is a hard and pyriform tumor in the hypogastric region, extending along the median line toward the umbilicus. The swelling is tender to the touch, which is greater if the bladder be inflamed; there is dullness on percussion; on account of the rigidity of the abdominal muscles there is inability to detect fluctuation by percussion; this is best elicited by introducing the finger into the rectum, placing it in contact with the bladder, and tapping the tumor.

The pain that the patient experiences soon becomes of a most excruciating character; the respiration is short and shallow; the desire to pass urine becomes more and more urgent, accompanied by tenesmus, rigors, alternating with flushes of heat, great thirst, hot and dry skin, restlessness; the urine is either not passed at all or comes away by drops or in a tiny stream.

After the retention has existed for two or three days there is involuntary incontinence of urine, which means that the bladder is overdistended, causing partial paralysis of the sphincter of the bladder.

If the patient is not speedily relieved, pains in the loins and tenderness over the kidneys supervene; there is headache, the pulse becomes weak, small, and rapid; there is urinous odor of the breath and perspiration, dry tongue, delirium, subsultus tendinum, coma, and death. Death occurs from uræmic poisoning in from four to five days. The bladder may rupture and empty its contents into the peritoneal cavity, giving rise to peritonitis gangrene, or abscess of the kidney may ensue.

Diagnosis.—Care must be taken not to confound retention of urine with pregnancy or ascites.

The **treatment** must be guided by a knowledge of the cause, but in all cases it is necessary to relieve the bladder as soon as possible.

If a calculus is impacted, means must be adopted to remove the obstruction; if the calculus is in the urethra where it can be felt, it may be worked forward by the finger until it reaches the orifice, where a small incision may be necessary; or it may be extracted with the urethral forceps. If it is fixed, or too far back, the skin over it may be stretched with the finger and thumb of the left hand, and a small longitudinal incision may be made on it. The wound must be dressed antiseptically.

A catheter should be passed immediately, if the symptoms are urgent; but if the patient can wait for half an hour he may be placed in a hot bath and given a full dose of opium or laudanum. The bowels must be thoroughly opened as soon as possible; the urine rendered unirritating by the use of alkaline carbonates, and sedatives and all stimulants forbidden.

If the distention of the bladder be excessive, all the urine must not be drained off at once; withdraw about one-half the first time and the remainder some hours after. Be careful to place the patient in a sitting or recumbent posture before commencing the operation.

Retention of urine may occur to individuals who are affected with gonorrhœa, and, thinking themselves well, have indulged in the pleasures of the table or in over-drinking. In such a case a soft, well-oiled catheter should be introduced, and afterward a hip bath should be ordered, together with a suppository of opium, three grains; extract of belladonna, half a grain. Perfect rest should be enjoined.

Newly-born infants may be affected with retention by reason of imperforate prepuce or imperforate meatus; in the former case it may be necessary to circumcise the patient, and in the latter cases a meatus must be made. Introduce a catheter if necessary. If it be due to a cyst in the sinus pocularis, as is frequently the case, it will be at once relieved by passing in a small probe and rupturing the wall of the sac.

In passing the catheter the patient lies on his back near the edge of the bed, the head being supported on a pillow and the knees separated from each other and slightly raised. The instrument should be about ten inches long, beak well rounded, eyes well beveled and smooth, and should describe the segment of a circle. Before introducing a catheter *it must* be thoroughly sterilized and lubricated, preferably with sterile liquid vaseline. It should then be grasped with the index finger and thumb of the right hand; and, standing on the left side of the bed, raise the penis at right angles with the body, grasping it with the middle and ring fingers of the left hand, leaving the thumb and index finger free to retract the prepuce and separate the meatus. Hold the handle of the instrument in a line with the linea alba, its concavity being directed toward the abdomen, draw the meatus of the penis over the catheter, at the same time push the catheter into the meatus with the other hand. The soft rubber or silk web instrument should always be used where possible. At about 5 or 5½ inches an obstruction will be encountered; when this point is reached, stop for a moment and withdraw the catheter about the eighth of an inch, and then raise the catheter over the obstruction, depressing the handle, when the catheter will glide into the bladder. If the resistance cannot be overcome, then desist in your efforts to introduce the instrument.

When the patient has stricture pass a nickel-plated conical steel bougie (No. 21, French; 12, English) into the urethra until the obstruction is reached; keep the back of the bougie gently pressed against the stricture, when after a little while the spasm will be overcome and the bougie will pass into the bladder; if it does not, next take an olivary-tipped bougie (No. 1, English; 3, French), which may be passed readily, then use successively larger bougies, and thus dilate the stricture.

If the stricture be a very tight one, inject the urethra with oil and introduce a filiform; when the obstruction is reached, gently rotate the filiform, until it passes onward into the bladder. *The filiform should always be employed before resorting to any other method of dilatation; if this rule be not observed the operator will be unable to pass that instrument.*

Now attempt to pass Goulay's tunneled catheter by threading it in its onward passage by the already introduced filiform.

The operator having failed to pass an instrument, suprapubic aspiration should be employed if the patient is in a weak condition; if, however, the patient be robust, recourse should be had to perineal section, with or without a guide.

Enlarged prostate generally occurs after the age of sixty. Care must be taken when retention occurs from this cause not to draw off all the urine at one time, nor to use a catheter with a long beak, lest the bladder contract on the instrument and inflammation result.

The instrument to be employed is that known as the Mercier prostatic catheter, or the bi-Coudé may be used. Brodie's over-curved silver catheter popularized by Gross may be used and can often be successfully passed when other instrumentation fails. If there be distortion of the urethra to the right or left the rat-tailed silk web catheter may pass. If the passage of an instrument be found impossible, aspiration or suprapubic cystotomy should be employed.

TAPPING THE BLADDER.

When the catheter, bougie, and other means fail, aspiration, suprapubic tapping, may be resorted to. In aspiration the instrument is passed about 1½ to 2 inches above the symphysis in the middle line, directing it downward and backward; this operation may be repeated two or three times a day.

In suprapubic tapping, make an incision along the middle line above the pubis, from an inch to an inch and a half in length, down to the connective tissue over the distended organ; through this opening the bladder is pierced at its lowest part by means of a long, curved trocar and cannula, the point of the cannula being inclined obliquely downward and backward. The cannula is retained by an appropriate bandage until it is desired to remove it.

Rectal tapping has been superseded by suprapubic aspiration.

HEMORRHAGE FROM THE URETHRA.

Hemorrhage from the urethra may be caused by the introduction of bougies, by a false passage, from internal injuries, by the separation of a slough formed by the caustic bougie, or by the rupture of a blood-vessel during acute chordee.

It may occur from general arterial excitement.

The recumbent posture, application of cold and pressure, should be tried. A flat piece of cork should be pressed by the patient against the perineum, far back, and gradually moved forward till it lights on the right spot, and the dripping of blood will cease. A solution of tannic acid in water may be used as an injection. Gallic acid may be of service. Irrigation with a solution of adrenalin chloride may control the bleeding.

A steel bougie, first put in very hot water and then introduced into the urethra, is often used to arrest this variety of hemorrhage.

If the hemorrhage is from the anterior portion of the urethra, insert *a catheter*, and apply a bandage firmly around the penis.

CHANCROID.

Soft chancre, or *non-infecting sore.*

This is a highly contagious suppurating ulcer, capable of being inoculated on the same patient; it is a local disease, and produces an ulcer wherever it may be introduced; unless *infected by syphilis,* there are no secondary symptoms; when the sore is thus infected it is called a mixed infection.

This is the most common form of venereal ulcer, and is rarely met with except on the organs of generation. The usual period of incubation is from 24 hours to 10 days.

Symptoms.—During the first twenty-four hours there is simply an irritated spot or point which reddens; on the second or third day it swells slightly and becomes a pimple, surrounded by a red areola; from the fourth to the fifth day the secretion increases and becomes purulent, and the vesicle becomes a pustule with a depressed summit. After the sixth day an ulcer appears; its depth is equal to the thickness of the skin, its edges seeming as though cut with a punch, its surface covered with a grayish, pultaceous matter. The discharge is purulent; the sore is painful and is not hard. It lasts from three weeks to three months, and is attended with a bubo, which tends to suppuration.

Diagnosis.—The affections with which chancroid is most liable to be confounded are chancre, herpes, eczema, and balanitis.

Chancroid may be distinguished from *chancre* by its rapid development, its increased secretion, absence of induration, its tendency to multiplicity, and the difference in the period of incubation.

From *herpes* chancroid may be known by the former usually presenting itself on the head of the penis and prepuce in little vesicles, about the size of the head of a pin, occurring in groups, set closely together, of a whitish color and resting on a florid base.

In *eczema* the little vesicles are more minute and diffused than in herpes, and there is generally greater local irritation, the parts being swollen, hot, red, and itchy.

In *balanitis* the inflammation is usually widely diffused, the discharge being profuse, and of a thick, muco-purulent nature; there is no circumscribed ulceration, as in chancroid.

Simple ulcers, abrasions, or excoriations may occur on the prepuce and glans, and care must be taken not to confound them with chancroid.

Treatment.—In the treatment of chancroid, S. D. Gross preferred the application of the official solution of the acid nitrate of mercury, applied either pure or diluted, according to the exigencies of the case; an average strength is one part of the acid to twelve parts distilled water, applied with a piece of soft wood, the ulcer being first dried with a bit of cotton, and immediately after bathed in sterile water; or, instead of the mercury, concentrated nitric acid may be used, so as to destroy the surface, the excess being carefully wiped off. Before cauterizing with nitric acid 4 per cent. cocain solution should be applied to allay the pain induced by the acid. After this has been applied, the sore must be dusted with iodoform and dressed with absorbent cotton moistened with black wash.

When the acid nitrate of mercury or nitric acid is not used, hydrochloric acid may be applied; Vienna paste is highly recommended. Ricord prefers a caustic compound of sulphuric acid and powdered charcoal, united in proportions to form a semi-solid; of this mixture apply a thin layer to the chancroid and the adjacent parts; allow it to dry, when it will form a black, adherent crust, which, on dropping off, leaves a healthy sore, followed by rapid cicatrization.

The parts should be frequently bathed in warm water, containing a small quantity of acetate of lead or common salt.

The ulcer must be kept covered with lint, wet with a weak solution of tannic acid and opium, a weak preparation of yellow wash (bichloride of mercury, gr. j, to lime water, ℥j), sulphate of copper (gr. v, to water, ℥j), or black wash. Many surgeons apply a powder composed of calomel and subnitrate of bismuth, each one part, and carbonate of zinc two parts; first carefully washing the parts, and afterward keeping them wrapped in a solution of lead water and laudanum.

Should phimosis supervene, inject underneath the prepuce, every two hours, first cleaning out the parts by syringing with hot water, an injection of Goulard's extract, twenty drops; alcohol, thirty drops; water, one ounce. If the syringe cannot be passed under the prepuce, put the patient under the influence of an anæsthetic, and slit up the prepuce as far as the corona glandis. Circumcision may be performed at once, but only under the strictest antiseptic precautions as the cut surfaces are very liable to become the seat of multiple chancroids.

If gangrene sets in—which is usually denoted by the appearance of a black spot, and by the prepuce becoming swollen and œdematous, and by subsequent sloughing—the patient must be placed under the influence of an anæsthetic, and the prepuce laid freely open; then dress with an ordinary simple dressing, or an application of lead water and laudanum. A very good application is a warm, moist, antiseptic dressing.

The diet must be carefully watched; animal foods and stimulants avoided, the nourishment being plain and simple; cooling purgatives administered from time to time.

Pain and morbid erections are relieved by opiates, bromide of potassium, or chloral, together with soothing applications to the parts.

Serpiginous sores are those that wander over the surface of the thighs and abdomen, healing in one direction and spreading in another; one of the most efficient local remedies for this condition is saturated solution of potassio-tartrate of iron, applied on lint; or it may be necessary to use solutions of nitric, carbolic, hydrochloric acid, and the actual cautery.

Opium should be given to allay pain. Quinine, mineral acids, iron, cod-liver oil, a liberal diet, exercise in the open air, and change of scene are the indications to aid recovery.

CHANCROIDAL BUBO.

A bubo is an inflammation of a lymphatic vessel or gland, from any cause, but it is commonly restricted to the inflammation of the inguinal glands which accompanies a venereal sore or gonorrhœa.

A chancroidal bubo is an enlargement of the lymphatic glands of the groin, and is the result of the transference of the virus of the original sore to the groin; it may arise during the existence of a chancroid, from the absorption of its poison, and is likely to suppurate quickly.

Inflammation of the glands of the groin is a common occurrence, either after the local application of a poison capable of being absorbed, or after inflammation of the skin or mucous membrane, or without any special local cause, during a period of constitutional cachexia.

The chancroidal bubo is usually limited to one or, at most, two glands. Bubo depending on true chancre is likely to be multiple and indolent.

The bubo usually occurs on the same side as the primary sore; when the chancroid is situated near the mesial line a bubo may be developed in each groin.

Acute bubo pursues the course of acute abscess, with its attendant symptoms, shivering, pain, tenderness, swelling; the skin becomes red and thin, then matter points and is discharged when the disease assumes this form, it usually runs its course rapidly, and is accompanied by severe constitutional disturbance. When the contents of the abscess are discharged, it is then called an open or *ulcerating* bubo, and the opening will be in the neighborhood of Poupart's ligament, either above or below, or partly above and partly below.

Indolent bubo occurs in persons of a weak and scrofulous constitution; after having made a certain amount of progress, it may remain stationary for some time, neither advancing nor receding.

Treatment.—In from two to three weeks after the appearance of a chancroid, in the proportion of about one case in four, a single lymphatic gland in the groin becomes swollen, painful, and tender; the overlying skin becomes red, œdematous, hot, swollen, and inflamed; a soft spot appears upon the swelling, and after a little while there is decided fluctuation, and an abscess is formed in the gland. As soon as the gland begins to swell and becomes tender, charge a syringe with the 1 : 500 solution of corrosive sublimate, or with a solution of carbolic acid, 8 grains to the ounce, and inject a few drops into the gland, and repeat this in different portions of the diseased structure until fifteen or twenty drops of the solution have been introduced. If this does not arrest the formation of pus, it will be necessary to wait, and when the pus is formed lay the abscess freely open and thoroughly remove all involved skin and overhanging edges.

If there is much inflammation, put the patient to bed, purge him, and place him on the mildest diet.

An operation is not to be performed until the gland has thoroughly softened.

Before opening the bubo the part is to be shaved and disinfected. The incision is to be made *parallel to the long axis of the swelling.* The pus must be entirely evacuated, when the cavity is to be washed out with a bichloride solution. The upper flap of the wound must then be seized with a pair of hæmostatic forceps, and cut away, using a pair of curved scissors for the purpose; the lower flap is then to be removed. Scrape the wound with a curette and remove all remaining portions of broken-down gland. When oozing has ceased, mop the entire surface with pure carbolic acid and pack the cavity with iodoform gauze. The part must be daily dressed. Another very useful method is to open the abscess through a small slit and evacuate the pus. Syringe the cavity with 3 per cent. peroxide of hydrogen until clean, then wash out thoroughly with a solution of bichloride of mercury 1 :1000 and inject the cavity with a 10 per cent. ointment of iodoform in vaseline. Place ice over the gland to harden the vaseline and dress with collodion and cotton and a spica of the groin. On the succeeding days the same technique of cleansing and injecting are followed out until the discharge ceases, when an ordinary pressure, dressing and bandage are applied until the parts heal by granulation. Always make the inside opening in the abscess cavity larger than the outside, in order to permit free drainage when the peroxide of hydrogen is introduced.

SYPHILIS.

Definitions.—"Syphilis is an infectious, contagious, and inoculable disease, of slow evolution; it first manifests itself by an indurated or infecting chancre, afterward by eruptions of the skin and mucous membranes, later by chronic inflammations of the cellulo-vascular tissue and bones, and finally by special productions in the form of small tumors or nodules, which have received the name of gummata."—*V. Cornil.*

"Syphilis is a constitutional contagious disorder which may be acquired or inherited, the first manifestation of which, unless it be inherited, is a chancre."—*S. W. Gross.*

This disease is due to the introduction of a specific poison or virus from an infected person into the body of a healthy person, in which individual the poison is disseminated by the blood and gives rise to certain inflammatory lesions and new formations. It is usually transmitted by the secretions of a chancre, during impure sexual congress. An individual laboring under secondary syphilis can transmit the disease as readily as one affected with primary syphilis; the blood of a person laboring under secondary syphilis is inoculable; the flesh is likewise poisoned.

The secretion of what is known as the mucous patch is inoculable; it gives rise to chancre. If a female labor under secondary syphilis, any discharge which she may pour out from her uterus or vagina will give syphilis to a man having connection with her. Syphilis may be transmitted by other means than impure sexual intercourse, as by kissing a child with inherited syphilis, or by infecting the nipple of a nurse when the sucking child has mucous patches, or by smoking a pipe, or using a drinking utensil of an infected person, etc.

The symptoms of syphilis are divided into three stages: primary, secondary, and tertiary:

Primary syphilis is the initial lesion or chancre, with enlargement of the associated lymphatic glands.

Secondary syphilis includes the more superficial inflammatory lesions of the skin, mucous membranes, and their appendages.

Tertiary syphilis comprises the destructive inflammation of the skin and mucous membranes and their appendages, as well as lesions of deeply-seated tissues of the various organs of the body.

CHANCRE.

Chancre is the initial lesion of syphilis.

Varieties.—A chancre may make its primary appearance simply as a fissure or crack; or as a papule from which the epithelium desquamates and re-forms, sometimes leaving a superficial hard base. It may present itself in the shape of a tubercle, or as a deep, indurated, excavated ulcer known as the Hunterian chancre. It may first appear as a crop of vesicles, which is the herpetiform variety of chancre. Then again there is the mixed infection, where the chancre and the chancroid are combined; this is very uncommon. The silvery spot is a rare form.

A chancre does not at once appear after a person has been inoculated. The minimum period of incubation of syphilis is ten days; the maximum period is ninety-eight days; the average period is twenty-one days.

Symptoms.—A chancroid may not appear until ten days, and a chancre never appears before ten days. In two-thirds of all cases the chancre makes its appearance as a superficial ulcer. It may present itself as a deep, funnel-shaped ulcer, or again as an elevated, hard, desquamating papule or tubercle.

Induration of the base of the ulcer is an important sign. The induration may feel, when moved about between the thumb and fingers, like thin parchment; or it may be a sore seated upon an indurated base about the size of a split pea; the induration may appear previous to the sore, or *vice versa*. This induration is present in ninety-five per cent. of all cases. Whether present or not, if the disease be syphilitic, there will be found in the groin a number of very hard, distinct glands, rolling under the fingers.

In addition to being superficial, the ulcer is clearly cut, the edges are perpendicular, not undermined, and look as though made with a scoop. The secretion is serous. The sore is smaller than in chancroid; it is not attended with pain or inflammation. Its tendency is to heal.

The most common seat of chancre is on the glans penis, dorsal surface of the penis, the meatus, the anus, and lips in the male; and the labia, nymphæ, the entrance to the vagina, the fourchette, and the nipple of the female.

The ulcer will disappear in two or three weeks, leaving an induration which may last several months.

Bubo.—A constant concomitant of chancre is bubo.

If the chancre be upon the genitals, the glands of the groin will be found enlarged in ninety-five per cent. of all cases. It will be met with on the same side as the lesion; or, if the chancre be seated upon the median line, buboes will be found on both sides. If the chancre be upon the nipple the bubo will be found in the axilla. The bubo of chancre differs from that of chancroid in there being a number of swellings on either side instead of one; they will vary in size from a buckshot to a hazelnut; suppuration occurs in the proportion of one case in every twenty-seven; but in chancroid suppuration always takes place. The bubo will present itself in from eleven to fourteen days after the appearance of the initial lesion.

Treatment.—If an individual present himself soon after impure connection, with a slight abrasion or sore upon the penis, wash the part carefully, dry it with a soft cloth, and then dust it with a powder consisting of equal parts of calomel and finely powdered subnitrate of bismuth, covering it with a thin layer of cotton. Should the chancre not show a disposition to heal, apply any mild stimulating solution, as the black wash, red wash, nitric acid lotion, or a five- or ten-grain solution of nitrate of silver.

Local baths, either simple or medicated, are highly recommended. After bathing, the best local application is a moderately strong solution of acetate of lead, combined, or not, with opium, applied on soft lint or cotton wool, and covered with oiled silk.

Should phagedena present itself, it must be treated upon the same principles as would be observed in the disease occurring in any other ulcer. Destroy the sore by means of cauterants. If the chancre be at the meatus keep the parts soft by a constant application of a vaseline.

SECONDARY SYPHILIS.

Secondary syphilis is that group of morbid phenomena which present themselves the first two years after the occurrence of an attack of primary syphilis.

Secondary syphilis is always preceded by chancre, and it may come on before the initial lesion has disappeared.

It is usually ushered in by well-marked constitutional phenomena; the patient feels uncomfortable and unwell; is irritable and despondent; countenance has a dull, muddy aspect; limbs and joints are sore and stiff; his appetite is impaired; his urine is scanty and high colored; is easily fatigued; has headache and disturbed sleep.

After a few days he is seized with rigors, followed by high fever, or by fever and profuse sweats.

The attack is called syphilitic fever, and is an effort of the system to eliminate the poison.

The skin and mucous membrane, with the posterior cervical glands, are the parts most liable to attack.

Affections of the Skin.—Of these there are six varieties, viz.: the exanthematous, scaly, vesicular, papular, pustular, and tubercular.

Syphilitic eruptions are generally chronic; in form more or less circular, and usually copper colored; after having existed for some time they become of a grayish, muddy, or bronze appearance; usually appearing on the forehead, nose, cheek, back, and shoulder; they are accompanied or followed by grayish, hard and thick scales, greenish scabs, narrow cracks, or well defined ulcers.

In the *exanthematous* form the spots are pinkish, reddish or of a pale copper color; they are most prominent on the trunk and extremities, and usually pass off with a slight desquamation of the cuticle. This eruption will make its appearance between the sixth and twelfth week after the appearance of the initial lesion.

As the eruption fades it loses its reddish tint, and assumes a dingy, dusky aspect. Duration from ten days to six weeks.

The *scaly variety*, or *psoriasis*, comes on from two to six months after the primary disease; it is always chronic, and is often associated with ulceration of the throat and palate, iritis, affections of the bones and joints.

The disease presents itself in thick scales of a dull grayish appearance. It may occur on any part of the body, but is most commonly met with on the forehead, scalp, face, forearms, palms of the hands, and soles of the feet.

The *vesicular variety* is very uncommon; it usually begins with minute, circumscribed pimples, scattered over the body, that are covered by a transparent, serous fluid, surrounded by a reddish, copper-colored areola. They are most common on the neck, chest, and extremities.

The *pustular variety* are circumscribed elevations of the skin, occupied by pus, and readily tending to ulceration. They range in size from a pea to an ordinary marble. They exist in great numbers; each pustule rests upon a hard, copper-colored base.

After a time the contents of the pustule escape, concrete, and form hard, thick scabs, of a dark brownish color, firmly adherent.

The *papular* syphilis or *lichen* is distinguished by the appearance of small, hard, solid elevations, containing no fluid, and generally terminating in desquamation, seldom in ulceration. This affection may be *acute* or chronic.

The *tubercular* form of syphilis exists in two varieties; in the first the eruption consists of small, red, copper-colored eminences, varying in size from a small bird shot to that of a pea; they are smooth and polished, and soon become covered with a dry, scaly crust.

In the more aggravated form the tubercles are larger, of a deep violet color; after continuing for a longer or shorter period they inflame, suppurate, and are replaced by deep, foul, painful ulcers.

Loss of hair from the scalp, eyebrows, and lids is common as an early symptom. When the system is saturated with the virus, the beard and the hair of the rest of the body may also disappear.

Affections of the mucous membranes are liable to appear within four or five weeks after the initial lesion.

The parts usually affected are the tonsils, palate, pharynx, tongue, cheek, and lips. Well-marked signs of the disease frequently appear at the anus and lower part of the rectum, upon the foreskin and head of the penis of the male, and upon the vulva, vagina, and uterus of the female.

Secondary affections of the mucous tissue occur in various forms, as an erythematous disease, as a tubercle, or as an ulcer. Syphilitic *erythema* occurs most frequently in the throat, affecting the arches of the palate, uvula, pharynx, and sometimes the root of the tongue.

The inflammation is either diffused, or it occurs in distinct mucous patches of a circular or oval form; it is of a copper color.

Ulcers of the throat generally make their appearance on the uvula and tonsils, arches of the palate, and back of the pharynx.

The superficial ulcer is either simply an erosion, or a cavity with well-defined, ragged edges, rather sharp and somewhat undermined. It usually presents itself early after the primary sore.

In the excavated ulcer the edges are steep, everted, or ragged, and are surrounded by a hard, inflammatory, copper-colored base; the discharge is thin and ichorous; the sore is most distinctly marked on the tonsils. They are liable to take on phagedenic and gangrenous action, and extensive destruction of the soft palate frequently results. The excavated form of the disease is usually accompanied by extensive swelling, together with great pain and difficulty in swallowing. Mucous *tubercles* generally occur upon the tongue, lips, inside of the cheek, tonsils, and palate; they are slight elevations of the mucous surface, usually of an irregular oval or elongated shape, and of a whitish hue.

The treatment of secondary syphilis should be hygienic, tonic, and specific. The patient should be careful not to eat indigestible food; he should take exercise in the open air at stated periods, not to the point of fatigue; his habits should be regular; he must discard the use of tobacco and alcoholic drinks, unless he be an habitual drinker, when he should diminish the quantities hitherto taken. He should take a tepid bath every night before going to bed.

When the patient is greatly debilitated, and anemic, a tonic treatment is to be resorted to.

The specific plan of treatment consists in the proper administration of mercury.

It is necessary to begin with very small doses of the mercury until the susceptibility of the patient is determined. The rule is to avoid anything like the approach of ptyalism. After each dose of the remedy the mouth should be thoroughly washed out with a solution of chloride of potassium, in the proportion of twenty grains to an ounce of water.

Mercury may be administered by the mouth, stomach, inunction, fumigation, by the rectum, or hypodermatically.

If the patient be weak, debilitated, and suffering from an impaired condition of the blood, it is well to combine a tonic plan of treatment with the mercury. If the patient be in ordinary health, give him a pill of one-fifth of a grain of protiodide of mercury three times per day. Always determine the physiologic dose of mercury by cautiously increasing the dose as follows: At the expiration of two days add a second pill to the mid-day dose; if this does not produce griping or diarrhœa, add a third pill; making one pill after breakfast and supper and three pills after dinner; should the patient become griped, fall back to three pills daily.

If an extremely speedy action of mercury is required, as in the case of iritis and in malignant syphilis, the remedy should be used hypodermatically; the following is the best formula: bichloride of mercury one-tenth of a grain, hydrochlorate of cocaine half a grain, water fifteen minims.

If mercury produces griping and diarrhœa, then it will be necessary to resort to inunction; use for the purpose equal parts of blue ointment and petroleum, rubbing in one drachm every day.

If for any reason inunction is not advisable, then resort to fumigation. Finally, mercury may be given by the rectum.

Keep the patient upon the combination of protiodide of mercury after all lesions have disappeared.

If at any time during the treatment of secondary syphilis a lesion of tertiary syphilis makes its appearance, iodide of potassium must be combined with the mercurial treatment; when the tertiary symptoms disappear, omit the iodide of potassium.

If a papular eruption presents itself, anoint the parts with a five per cent. oleate of mercury, to which any aromatic oil may be added; or an unction may be used of ammoniate of mercury half a drachm, cosmoline one drachm.

To remove the crust in impetigo, apply an antiseptic poultice; when it has become sufficiently softened use a preparation, spread upon lint, composed of ointment of nitrate of mercury one drachm, cosmoline seven drachms.

When there is a moist papular eruption of the skin, with an ulceration of the epidermis, the parts should be carefully washed three times a day with tepid water and chromic acid, or a weak solution of corrosive sublimate and water should be applied once during the twenty-four hours; in the interval the parts are to be dusted with a powder of one part calomel, two parts oxide of zinc; then lay over each papule a piece of absorbent cotton.

When the patient is threatened with *alopecia,* the hair should be cut short, and mild lotions of alcohol and aqua ammonia should be applied, or alcohol glycerine, and tincture of cantharides may be used, or a wash composed of tannic acid gr. vj, sulphate of copper gr. ½, bay rum and water each an ounce; or tincture of cantharides two drachms, aromatic spirit of ammonia half an ounce, rose water four ounces, and corrosive sublimate four grains.

Iritis, which occurs in the advanced stages of syphilis, must be treated early and vigorously. The patient must be promptly brought under the influence of mercury, as the disease usually affects both eyes and extends rapidly to the cornea, choroid, and retina. As soon as the gums become slightly tumid and there is salivation, cease to administer the remedy. The action of the mercurial may be hastened by applying a mercurial inunction.

A solution of atropia, one grain to water one ounce, is to be dropped into the eyes. If there be great pain apply eight or ten leeches to the temple. To relieve the pain, opium in combination with a diaphoretic must be administered; say Dover's powder grs. v, or sulphate of morphia gr. ⅙, every five or six hours.

The most suitable local remedies to the mucous surfaces are nitrate of silver in substance, or acid nitrate of mercury variously diluted. When the part is ulcerated the preference is given to the acid nitrate of mercury, diluted with eight or ten parts of water.

Nitric acid, carbolic acid, or hydrochloric acid, properly diluted, may be used as substitutes for the acid nitrate of mercury.

Gargles composed of pyroligneous acid ʒij, water ℥viij, honey a sufficient quantity; or subacetate of copper and tannic acid; or tannic acid and glycerine; or nitric acid and chlorinated sodium, may all be advantageously used in turn.

TERTIARY SYPHILIS.

By the term tertiary syphilis is generally understood the lesions of the disease which show themselves, as a rule, after the expiration of two years from the commencement of the primary sore.

They consist of deep, destructive ulceration of the skin and mucous membranes, the occurrence of a form of tumor called gumma, of fibroid induration and thickening of the organs and their capsules, and of obliterating inflammation of the lining membrane of the arteries.

The textures most prone to suffer in tertiary syphilis are the connective tissues, mucous membranes, periosteum, bones, fibro-cartilages, aponeuroses, tendons, and testicles.

The most common of the internal lesions are gummy tumors, foul, ragged-looking ulcers, softening and pulpy degeneration, and tubercular deposits.

The most important and frequent lesion of tertiary syphilis, and which may be looked for in from two to five years after the appearance of the primary lesion, is the gumma, so called from its gummy discharge when it is broken down. It is a tumor made up of granulation tissue; it is more or less spherical in shape, of hard, elastic consistence. Gummata may be ulcerating or non-ulcerating. Gummata are found most frequently in connection with the skin, subcutaneous tissue, muscles, bones, periosteum, liver, brain, lungs, and testicles.

Tertiary syphilis is very common in the brain and spinal cord, and shows itself in a variety of ways; it gives rise to epilepsy, locomotor ataxia, paralysis of one or both of the facial nerves, hyperæsthesia, and affections of the nerves of special sense.

In *tertiary syphilis* the lesions of the skin differ from those of secondary syphilis in being destructive, affecting the deep layers; the most common form are the tubercular, which are apt to undergo destructive ulceration; the deep pustular; the impetigo, the ecthymatous, and the rupial eruptions.

The affections of the mucous membranes consist in the occurrence of ulcers, and of mucous patches about the mouth.

The eyelids are frequently attacked by the disease; it generally shows itself as an indurated ulcer of an oval shape; the borders are inflamed and thickened, and the conjunctiva is usually inflamed.

Affections of the periosteum and bones present themselves in the form of nodes or gummy tumors, inflammatory hypertrophy, exostosis, caries, and necrosis. These affections may come on at any time after eighteen months from the first affection. They are most liable to occur in persons of a scrofulous habit, or whose constitutions have become impaired from any cause.

The bones affected with tertiary syphilis are those that are superficial, or least protected by the soft parts, as the tibia, fibula, ulna, clavicle, and bones of the skull, nose, palate, and upper jaw.

Nodes occur usually upon the tibia, ulna, clavicle, frontal and parietal bones.

They are usually circumscribed, semi-solid swellings, of an ovoidal shape, and of a slightly elastic touch.

The periosteum and bone are inflamed, softened, and ulcerated, and as the tumor extends, the structures over the seat of the disease become red and painful, and ulceration finally takes place at the most prominent point.

The course of the disease is chronic, and it is attended with an intermittent, neuralgic pain, greatly increased at night.

Caries is most common in the long bones of the extremities, in the skull, and in the palate, maxillary, nasal, turbinated, ethmoid bones, and vomer.

Hypertrophy of the osseous tissue is exceedingly common, and may involve many of the bones; those most liable to be attacked are the tibia, fibula, femur, ulna, radius, and cranium. The tumor is usually knotty and irregular, with a broad base and a rough, scabrous surface; in long standing cases it becomes hard, and of the consistence of ivory.

Treatment.—Iodide of potassium, given in solution, is the remedy most frequently resorted to in tertiary syphilis; fifteen grains three times a day is a medium dose, but it is often given in much larger quantities; it should be taken about an hour after eating.

Iodide of potassium is generally combined with carbonate or muriate of ammonium, or iodide of sodium, or iodide of ammonium; the average doses of these remedies is about eight grains; their efficacy will be enhanced by the addition of a small quantity of mercury; the form of mercury usually preferred is the bichloride, in doses of $\frac{1}{16}$ to $\frac{1}{8}$ of a grain, three times daily. A good substitute for the bichloride, should it disagree with the patient, will be found in the biniodide.

In treating tertiary syphilis it is to be remembered that the iodides will only temporarily remove the lesions of this malady, but they will not prevent recurrence, hence mercury is usually given in combination. It should be persisted in for at least six months after all evidence of the disease has disappeared, and after the iodides have been stopped.

Donovan's solution is a remedy in general use, the dose being from five to eight drops. Tonics, as a rule, are indicated; quinine and iron are usually preferred.

Sudorifics are highly praised when there is obstructed perspiration; Dover's powder, antimony, morphia, warm or steam bath, are the remedies usually recommended.

Anodynes are most valuable auxiliaries, it being of vital importance to produce sleep and to quiet the nervous system; morphia, laudanum, black drop, or opium must be used in sufficiently large quantities to answer the indications.

For ulcers, fissures, eruptions, etc., the topical treatment generally in use are weak solutions of nitrate of silver or acid nitrate of mercury; when there is much inflammation present, acetate of lead and opium may be employed.

Syphilitic *onychia* is best treated by the application of 10 per cent. ointment of the oleate of mercury rubbed into the parts after soaking in warm water.

Tertiary ulcers of the throat, mouth, and *tongue* are most beneficially treated with applications of acid nitrate of mercury or solid nitrate of silver. Weak gargles or washes of acetic acid, tannic acid and sulphate of copper, chlorinated sodium, may be employed in the intervals.

For *syphilis of the nose,* injections of weak lotions of iodide of iron, sulphate of copper and tannic acid, tincture of myrrh, permanganate of potassium, and chloride of zinc are most to be relied upon.

The remedy for syphilitic *iritis* is mercury pushed to rapid ptyalism.

For ulcers of the *eyelids,* use iodide of potassium, and apply dilute ointment of nitrate of mercury.

The pain in the bones is relieved and swelling abated by applying tincture of iodine, and blisters. If the ulcer is slow to heal, apply a blister and dress it with mercurial ointment.

If a gumma makes its appearance somewhere on the subcutaneous connective tissue, besides relying upon the specific mixed treatment already laid down, make an application to the part of tincture of iodine two or three times daily; if it be on the hand or arm, place the limb nt, apply the tincture of iodine, and make compression with

If the gumma be already opened when first seen by the surgeon, apply the usual dressing of corrosive sublimate solution, and when the gummy matter has been excluded, apply some stimulating lotion.

Inherited Syphilis.—If a mother is affected with secondary syphilis, she should be placed upon specific treatment as soon as she is found to be pregnant.

The child, when born, should be placed upon the mercurial plan of treatment. It should be given one grain of mercury, with chalk, rubbed up with sugar, twice a day, gradually increasing to two grains a day. One-fifteenth of a grain of Dover's powder may be added to each dose if the mercury disagree with the child; or the mercurial may be introduced into the system by inunction, by smearing the end of a flannel roller with five per cent. oleate of mercury and carrying it around the abdomen.

TUMORS OR MORBID GROWTHS.

Tumors are divided into two groups: The neoplasms and the cysts.

A neoplasm is a pathological growth performing no physiological function. Neoplasms always tend to persist whilst inflammatory exudates are capable of solution. There are two great classes of tumors: (1) Those derived from connective tissue structures. Of these there are two principal varieties, the benign and the malignant. The benign are composed of an overgrowth of adult cellular elements, the malignant those composed of embryonic connective tissue cells. (2) Those derived from the epithelial structures. These tumors are also classed as benign and malignant. The benign take origin from adult epithelial cells, whilst the malignant revert to the embryonic type of epithelial cell for their origin.

Connective tissue tumors arise from mesodermic structures; epithelial from epidermic or endodermic.

Causes of Tumor Growth.—There have been many theories put forth from time to time to account for the growth of tumors. Many of these are now extinct, whilst a few are still taught.

Inclusion Theory of Cohnheim.—This supposes that in the construction of the individual there are more embryonic cellular elements put forth than are needed. The unutilized embryonic cells persist in the adult in their embryonic form as cell-rests within the tissues. From some cause unknown these cell-rests may be excited to growth and reproduction, producing a tumor.

Parasitic Theory.—There are some pathologists who believe that certain organisms are responsible for tumor formation.

Hereditary influences seem in some cases to exert a powerful tendency toward their presence. Likewise injury and inflammation play a part in their production.

Growth of Tumors.—Malignant tumors as a rule do not possess a well-defined capsule; benign tumors as a rule do. The malignant tend to infiltrate the surrounding tissues by outgrowths and also by involvement of the lymphatics if carcinoma, and the blood vessels if sacroma. The capsule of the benign growth usually limits it. An innocent growth may and often does become malignant through irritation. The rapidity of growth is an important item in diagnosis. The malignant usually grow fast, the benign more slowly. Sarcoma is a growth usually associated with physiologic activity; carcinoma with the senescent period of life. Some benign tumors tend to destroy life from a vicious position.

Lipomata are fatty tumors resembling ordinary adipose tissue excepting that the vesicles are larger. They possess a matrix composed of fibrous tissue. When the matrix is in excess the growth is a fibrolipoma. They may be either congenital or acquired. They have distinct capsules attached to surrounding structures by fibrous bands that cause dimpling in the overlying skin when the growth is moved. They are most common during middle life and do not tend to malignancy, although they may rarely become sarcomatous. They may be multiple and are sometimes mistaken for Hodgkin's disease.

Treatment.—When single they should, if causing annoyance or occupying a dangerous position, be removed by enucleating. A diffuse lipoma is difficult to remove. Always insert drainage after removal as fat fermentation and infection are liable to follow.

Fibromata are fibrous tumors composed of interlacing bundles of fibrous tissue. They form encapsulated movable masses, either lobulated or uniform in contour. They are of two clinical varieties, the hard and the soft. The hard are mostly found in connection with the periosteum, fasc[illegible] and nerve sheaths; the soft in the skin and submucous tissue. A special form is known as The Painful subcutaneous tubercle. These are found on the lower extremities and the backs of the hands; they are situated in the true skin. They often give rise to darting pains of severe character, and, according to Virchow, are often associated with nerves.

Classification of tumors.

- Connectivetissue tumors of mesoblastic origin.
  - Benign. Those composed of mature connective tissue elements.
    - Lipomata, fatty tumors.
    - Fibromata, fibrous tumors.
    - Chondromata, cartilaginous tumors.
    - Osteomata, bony tumors.
    - Myxomata, mucous tumors.
    - Myomata, muscle tumors.
    - Gliomata, neuroglia tumors.
    - Neuromata, nerve tumors.
    - Angiomata, blood vessel "
    - Lymphangiomata, lymph vessel tumors.
    - Odontomata, tooth tumors.
  - Malignant. Those composed of embryonic connective tissue elements.
    - Sarcomata.
    - Endotheliomata.
    - Adrenal tumors.
- Epithelial tumors of epiblastic or hypoblastic origin.
  - Benign. Those derived from mature epithelial cells.
    - Adenomata, gland tumors.
    - Papillomata, papillæ of skin and mucous membranes.
  - Malignant. Those derived from embryonic epithelium.
    - Carcinomata or cancers.
- Cystomata. Cystic tumors containing a wall of new tissue composed of secreting cells that elaborate the contents of the tumor.
- Terotomata. Tumors containing elements derived from all three of the blasodermic layers.
- Sarcomata.
  - Round celled.
  - Spindle celled.
  - Giant celled or myeloid.
  - Alveolar.
  - Melanotic or pigmented.
  - Hemorrhagic.
  - Angiosarcoma.
  - Cylindroma.
  - Mixed tumors.
  - Endotheliomata.
  - Mycosis Fungoides.
- Cancers.
  - Epitheliomata.
    - Cylindric celled.
    - Squamous "
    - Tubular.
  - Rodent or Jacob's ulcer.
  - Spheroidal celled cancer.
  - Colloid cancer.
  - Scirrhous cancer.
  - Encephaloid cancer.
  - Cylindric celled cancer.

The fibromata are closely related to sarcomata, but do not tend to recur after removal.

Treatment.—Thorough early and complete removal in all cases where possible. Keloid, a special form occurring in the skin, rarely requires operation. The X-rays, according to Prof. John C. DaCosta, may cure.

Chondromata.—These consist of either hyaline or fibrocartilage or a mixture of both. They are firm and smooth; sometimes they are bossed or nodulated and may be hard or soft. They often arise from glands, the long bones, the pelvis and epiphysial ends of long bones. They grow slowly and are commonly seen in children. They frequently grow to enormous size. The chondromata of the parotid gland constituting the so-called mixed tumor, usually contains sarcomatous cells.

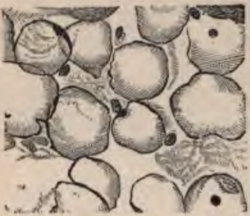


FIG. 24.—Lipoma. (*Gould.*)

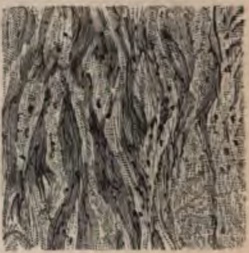


FIG. 25.—Fibroma. (*Gould.*)

Treatment.—They should always be removed as early as possible because of the tendency they have to become sarcomatous. Incise and remove the capsule as well as the periosteum when they spring from bones.

Osteomata are generally circumscribed, rounded, flattened and pedunculated more or less irregular in size and shape. J. Bland Sutton believes that osteomata are ossifying chondromata. Osteomata are either compact or cancellous. An exostosis is not an osteoma. They may exist in the dura mater and the larynx. They grow exceedingly slowly.

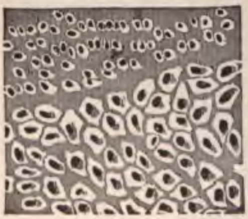


FIG. 26.—Chondroma. (*Gould.*)

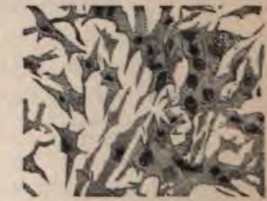


FIG. 27.—Myxoma. (*Gould.*)

Treatment.—When not growing and causing no trouble they may be left alone. When causing pain or productive of irritation they should be gouged away.

Myxomata are rare, having their counterpart in Wharton's jelly and the aqueous humor of the eye. True myxomata are extremely rare. Other tumors often present areas of myxomatous degeneration.

Treatment.—Remove them as soon as possible because of the danger of sarcomatous change.

Myomata take origin from unstriped muscular tissue. The uterus, scrotum, esophagus, stomach, prostate gland and labia majora are the sites where they are usually seen. The uterine fibroid is a myoma or a fibromyoma.

Treatment.—They should always be removed when possible, especially from the uterus, where they may give rise to serious trouble.

Gliomata develop from neuroglia. They are most commonly seen in the brain, spinal cord and cranial nerves. They often resemble sarcomata and many authors refer to a type of tumor known as the gliosarcoma.

Treatment.—Remove when possible.

Neuromata take origin from nerve tissue and are composed of medullated or non-medullated nerve fibers. The fibers composing the tumor do not connect with the axis cylinders or medullary substance of the nerve. A false neuroma or neurofibroma is largely composed of fibrous tissue and arises from the nerve sheath. Traumatic neuromata arise on the cut ends of nerves after amputation.

Neuromata frequently cause great pain and should always be removed. The fibro-neuroma may be carefully dissected free from the sheath without injury of fibers. When the nerve is cut always suture the ends of the nerve together.

Angiomata are largely composed of dilated blood vessels. They are divided into simple or capillary, cavernous and plexiform.

Simple angiomata are found in the skin and subcutaneous tissues; they are usually congenital and constitute the so-called port wine or claret stains commonly seen on the side of the face. They sometimes appear on the tongue, the labia and the lips.

Cavernous angiomata consist of dilated capillaries, forming blood spaces in the tissue. They may be either subcutaneous or cutaneous and are sometimes pulsatile.

Plexiform angiomata are minute aneurysms by anastomosis commonly spoken of as cirsoid aneurysm.

Treatment.—They usually produce great disfigurement when upon the face. Their removal may at times be attempted but the surgeon must bear in mind the great difficulty of complete removal. In simple angioma the skin may be removed and the raw surface grafted. Electrolysis may be useful.

Lymphangiomata are composed of dilated lymph vessels and are usually due to blocking of a main lymph vessel. Macroglossia and lymph scrotum are examples of this tumor.

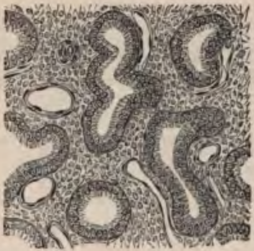


FIG. 28.—Adenoma. (*Gould.*)

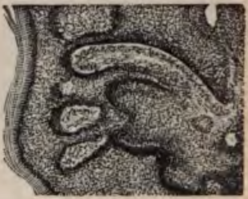


FIG. 29.—Papilloma. (*Gould.*)

Treatment is by excision when possible. If due, as is sometimes the case, to filaria, internal medication may benefit.

Odontomata are composed of tooth tissue. They as a rule spring from some portion of the dental follicle. J. Bland Sutton believes them to be of three separate kinds: Those arising from the dentine organ, those arising from the dental sac or follicular wall and those springing from the entire developing tooth germ.

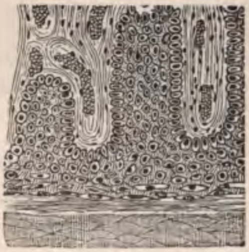


FIG. 30.—Epithelioma. (*Gould.*)

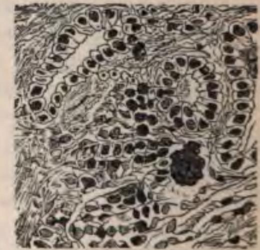


FIG. 31.—Cylindric Celled or Columnar Celled Epithelioma. (*Gould.*)

Treatment.—Remove them, curette and pack the crypt with iodoform gauze. Always remove the bony crypt.

Sarcomata occur most commonly in the young and during early life while the cells of the body are physiologically active. They arise from connective tissue and possess but a small amount of intercellular matrix. They usually proliferate rapidly. Metastases usually occur by way of the blood vessels. In most sarcomata the blood vessels are mere sluiceways throughout the tumor. Sarcomatosis is a general somatic dissemination of the sarcoma cells and their proliferation into sarcomata. Traumatism and bruises are apt to be followed by sarcoma; particularly is this true of the thigh and arm. They often develop from the benign mesoblastic tumors. The larger the component cells of the tumor the less malignant it is. Pigmented moles, when irritated, are very apt to develop into sarcomata.

Treatment.—Sarcomata should be carefully and thoroughly removed. The only chance the individual has is in the complete removal of the tumor and a good margin of adjacent tissue. Conservatism is dangerous.

The small round-celled sarcoma is the most malignant, and the smaller these cells the greater the malignancy.

Endotheliomata.—These tumors are regarded as a variety of sarcoma and spring from the endothelial lining of the blood and lymph channels.

Adrenal Tumors.—Growths arising from this gland are but partially understood. Many of them bear a strong resemblance to adenomata and carcinomata. They are of two general types, the benign and the malignant. The latter are usually sarcomata.

Adenomata.—Grow from glands and resemble the gland structure from which they spring. They frequently contain acini and tubules lined by epithelial elements. They are not as a rule physiologically active. They occur in the mammary, parotid, ovarian, thyroid, prostate, kidney, liver, sweat and sebaceous glands. The pathologist recognizes two varieties, the cystic and the fibro-adenoma. They possess a potent tendency to become malignant.

Treatment.—Remove boldly and early, especially when present in the female breast.

Papillomata are wart-like growths, resembling on a large scale mucous and cutaneous papillæ. They may be single or multiple and are usually fissured, giving them a sort of cauliflower appearance. They are frequent at muco-cutaneous orifices, such as the vagina, rectum and urethral orifice. They also arise upon mucous membranes in other situations where irritation is kept up.

The venereal wart is a common form.

Treatment.—They should always be removed and if possible the base well cauterized. They may often disappear after the application of cauterants.

Carcinomata or Cancers.—These tumors spring from epithelial cells and represent the embryonic type of epithelial elements. They have no capsules, in consequence of which they rapidly infiltrate adjacent tissues. A cancer apparently may arise from structures other than epithelial; this however is only possible by the growth of metastases or the presence of prenatal epithelial cell rests in the tissue. The most innocent form of epithelial tumor may suddenly become malignant. The metastases are always composed of the same type of epithelium as the parent growth. Cancer as a rule appears late in middle life or during old age and is frequently preceded by irritation of the area involved. This is seen in chimney sweep's cancer of the rectum; the malignant disease induced in the tongue by smoking clay pipes and that in the female breast following mastitis and abscess. The parasitic theory of production is as yet very much in the balance.

Epitheliomata.—These arise from the superficial epithelia and histologically correspond to the cells from which they grow.

Squamous Celled Epithelioma.—This form of cancer arises from either the skin or mucous membrane. The cells grow inward and from reciprocal pressure produce the characteristic cell rests or epithelial pearls. It is especially apt to appear at muco-cutaneous orifices, such as the angle of the mouth, the anus, the vagina and the nose. They also grow from the skin and are often preceded by a form of eczema which, when present upon the nipple, is termed Paget's disease.

Cylindric Celled Epitheliomata arise from surfaces or glands containing cylindric celled epithelium. They constitute the common forms of malignant growth met with in the alimentary canal and appendages. The uterus is often their habitat, whilst the kidney and liver rarely. They may rapidly disseminate but are usually of slow growth.

Tubular Epitheliomata are rarer than the above and are occasionally met with in the rectum.

Rodent Epithelioma or Jacob's Ulcer is a type of superficial carcinoma having a predilection for the skin of the face. They usually begin at the angle of the eye or mouth as a small fissured desquamating wart. This in later life breaks down, forming an ulcer. They do not tend to involve adjacent structures and are not of a violently malignant tendency. They rarely involve the lymphatics and generally begin in the sweat glands beneath the skin.

The diagnosis between rodent ulcer and lupus is sometimes difficult. Rodent ulcer does not tend to heal, whilst lupus does and its edges are indurated.

Scirrhous Carcinomata are composed of spheroidal cells contained within compartments formed by bands of connective tissue. It is most commonly resident in the female mammary gland. It begins as a hard circumscribed nodular mass in which the patient often experiences a sharp stabbing, burning or sticking pain. Later the skin may become adherent and produce dimpling that becomes exaggerated as the growth advances. The lymphatic nodes are rapidly involved and must be removed with the growth.

Encephaloid Cancer usually appears in the kidney, liver and ovary, and occasionally in the antrum of Highmore. It often contains pigment, producing the melanotic cancer.

Colloid Cancer.—These growths are rare and often arise from other forms of cancer. They probably are a form of degeneration. The colloid material resembles jelly. The stomach, intestines and mammary gland are the most common sites of this growth.

Treatment.—All cancers should be freely and generously removed as early as possible. Careful search should be instituted for involved lymph nodes and these removed. Most surgeons advocate the complete eradication of all lymph channels and nodes whether grossly invaded or not.

Cystomata may be congenital or acquired. They are composed of a wall of new growth lined by cells and composed of varying amounts of connective tissue.

Treatment.—They should be removed.

Teratomata are mixed tumors composed of elements derived from two or all three of the blastodermic layers. They are all congenital and may be traced to some prenatal defect of development. The most common forms are the branchial and dermoid cysts.

Treatment.—Remove them, making sure to allow none of the cyst wall to remain. The area should be thoroughly scraped by a sharp curette when any doubt exists as to possibility of a portion of the wall remaining.

ANEURYSM.

Aneurysm is a pulsating sac containing blood, and communicating with the interior of an artery.

An aneurysm consists of a sac formed by one or more of the arterial tunics.

Varieties.*—(1) *True,* one whose sac is formed by one or more of the vessel coats. (2) *False,* where the sac is formed by a condensation of the perivascular tissues. (3) *Traumatic,* a false aneurysm caused by injury of the vessel wall, the wound to vessel having healed and leaving the aneurysm. Disease of the vessels favors their formation. (4) *Fusiform,* a true aneurysm wherein the vessel is dilated in shape like a spindle. (5) *Consecutive,* a sacculated aneurysm that spreads by rupture of its walls and produces secondary dilatation. (6) *Sacculated,* one resembling a pouch and connected to the vessels by a small opening. (7) *Dissecting,* one where the blood does not dilate the coats so much, but tends to spread by separating or dissecting between the fibers of the middle coat. (8) *Arterio-venous,* where there is direct connection between a vein and an artery. (9) *Varicose,* where an artery and vein are connected by an intervening aneurysmal sac. (10) *Cirsoid,* dilated arteries forming a vermicular-like mass beneath the skin. Seen commonly on the head.

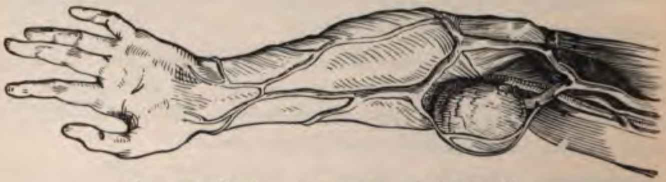


FIG. 32.—Varicose Aneurysm of the Basilic.

The rarer forms are the embolic, spontaneous, miliary, secondary ceruminous and acute.

Aneurysm usually commences by a giving way of the internal and middle coats of the artery, at the site of some softened spot, after which the pressure of the blood dilates the external or cellular coat into a pouch. It may commence by the dilatation of all three of the tunics.

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* Modified from DaCosta.

It gradually dilates under constant pressure of the heart's impulse, becomes lined with coagula deposited in distinct laminæ.

Symptoms.—If it is an external aneurysm it may be recognized by the following symptoms: At first there is a small tumor, pulsating strongly, and if the finger is applied to the artery between the aneurysm and the heart, the aneurysmal sac will be readily emptied by pressure; in the second stage, the blood is beginning to coagulate in the interior of the sac, the coats, at the same time, having become thickened. If the artery is now pressed upon, the sac will be emptied in part, and the swelling will be reproduced when the pressure is abandoned. There is some degree of pain and the circulation is retarded, in consequence of the pressure.

When the aneurysm reaches the third stage, it has acquired considerable magnitude, and the pulsation is, in a degree, lost; a small portion of the blood still remains fluid, but the greater part is filled with coagulum.

In internal aneurysm the symptoms vary, according to the seat in which the disease is found; the digestive organs will be at fault at one time, the urinary at another, and so on, depending on the part upon which the aneurysmal tumor presses.

Diagnosis.—Other tumors situated over arteries may be distinguished from aneurysm, by observing that they do not pulsate at first, when they are small, whereas aneurysms do so from their earliest formation; that a tumor may often be lifted up from the artery, and that then it will cease to pulsate; that aneurysms are generally soft at first and become hard afterward; tumors are generally the reverse; tumors cannot be emptied by pressure, and no alteration is made in their size or consistency by compressing the artery above. The pulsation of an aneurysm is expansile. In nearly all cases a *bruit* is heard on placing the ear over the tumor; it varies in different cases; it is blowing in its character, is not increased on pressure, and is heard equally well over the whole tumor.

The predisposing cause of aneurysm is some preëxisting degeneration of the arteries, which may be preceded by habitual overstain. Sir A. Cooper speaks of a case where there were seven aneurysmal tumors in different parts of the body frequently seen in tertiary syphilis.

Treatment by Compression.—It is applied upon some part of the affected artery between the aneurysm and the heart, and in such a way as to retard the circulation and so cause deposits of laminated fibrin.

Carte's circular tourniquet is used for the purpose; also Gibbon's modification of Charriere's compressor, or Hoey's clamp.

In some cases a five-pound bag of shot, or an ordinary four-pound weight may be placed over the artery, with a pad intervening, or "*digital compression*" may be used; kept up by relays of assistants, the patient, if necessary, being kept under the influence of chloroform or morphia.

The advantages of compression are, that it can be discontinued at once, if need be; secondary hemorrhage, the frequent accident of the ligature, is obviated; and even if it fails the knife can still be resorted to.

Compression is contraindicated when the integuments are inflamed, or the limbs much swollen, from venous obstruction, and also in cases which are very rapidly increasing.

The pressure should not be severe enough to cause great pain, and if there is room, it should be applied at two or three points in the course of the artery; and not carried to the point of completely closing the vessel. If very restless, the patient may be gently anesthetized, or kept quiet by morphia for two or three hours at a time.

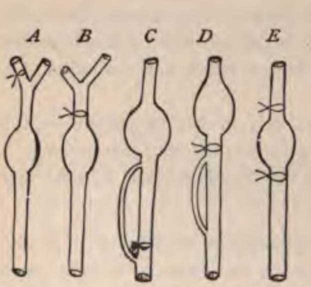


FIG. 33.—Different Methods of Ligature of Aneurysm. (*Walshaw.*) *A*, Antyllus's Method; *B*, Anel's Method; *C*, Hunter's Method; *D*, Brasdor's Method; *E*, Wardrop's Method.

By Ligature.—When compression is inapplicable or unavailing, the artery must be secured between the aneurysm and the heart by 1. **The Hunterian Method.** The place of election must be neither too near the aneurysm, so as to tie a portion of the vessel that is diseased, nor too far from it, lest the circulation through it be kept up too freely by means of collateral branches. The direction and extent of the incision obviously depends on the situation of the artery to be operated on. A healthy portion of the artery is selected, great care is taken, in exposing the vessel, to disturb the sheath as little as possible; two ligatures are used; they are drawn sufficiently tight to gently approximate the inner tunic; the stay knot is tied and the end cut short.

The other methods in vogue are: 2. Anel's operation; 3. Brasdor's distal ligature; and 4. Wardrop's operation.

2. **Anel's operation** is to apply a ligature to the affected artery close above the aneurysm. The objections to this method are that the operation is performed on a part of the vessel that is already diseased, and that the proximity of the wound to the aneurysm is liable to excite inflammation in and around the sac.

3. **Brasdor's distal ligature** is applied to the diseased artery beyond the aneurysm, on the distal side. It is resorted to in aneurysm of the carotid, innominate or subclavian artery, when the ligature cannot be employed between the aneurysm and the heart.

4. **Wardrop's operation** consists in tying one or more branches coming off beyond the aneurysm. It is a modification of Brasdor's operation.

In separating the artery from its accompanying veins, the greatest care must be taken not to inflict injury upon the vessels.

There have been many different methods devised for the treatment of aneurysm, some of which are as follows:

Tuffnell's Treatment.—This is carried out by diminishing the diet and securing as far as possible absolute mental and physical rest. Restriction of diet is supposed to render the blood more fibrinous, and consequently to favor clotting and cure. Liquids are reduced to 4 ozs. of water per day; 8 ozs. of milk; little butter and meat. This regimen is kept up for some time until the patient weakens, when he may return to a more generous diet, but only for a short interval. This treatment has cured aneurysm and probably does it by lowering blood pressure and increasing the power to clot. In aneurysm associated with syphilis anti-syphilitic treatment may cure; the iodides are of use in all cases. The injection of gelatin and the administration of sodium chlorid may do good. The insertion of silver or gold wire and the passage of the galvanic current through the wire may facilitate the formation of clots. This latter procedure has acted favorably upon aortic aneurysms.

ABDOMINAL SURGERY.

WOUNDS OF THE ABDOMEN.

Wounds of the walls of the abdomen may be caused by fragments of shell, and large portions of the integuments and muscles may be carried away; bullets and swords will frequently traverse the walls of the abdomen without penetrating, and missiles may strike the abdomen and inflict severe injury on the viscera without external injury.

Penetrating wounds of the abdomen, with or without injury to the viscera or large vessels, are followed by great mortality. If the contents of the abdomen are not injured, the chief danger is from peritonitis. When the viscera are wounded, the severity of the danger, in a great measure, depends upon whether a solid organ, such as the liver, spleen, or kidney, has been injured, or if the stomach or intestines have been perforated.

Wounds of the liver, spleen, and kidney are more fatal than those of the stomach and large intestines, and these latter more so than the small intestines.

Symptoms.—Great collapse is the first striking symptom; it is very severe if the viscera have been wounded; and is a common cause of death. Frequent vomiting is a symptom common in wounds of the intestines, particularly if the injury be high in the canal. The pain is great; and blood passed from the bowels is a usual symptom.

The after symptoms are those of peritonitis and such as are referable to the particular organ wounded, *e. g.*, blood with the urine, if the kidney be injured; or bile, if the liver, etc., etc.

Diagnosis.—As an infallible test of injury of the gastro-intestinal canal, in penetrating wounds of the abdomen, the rectal insufflation of hydrogen gas, as originally advocated by Professor Senn, is recommended. Under the modern antiseptic regimen, when in doubt, the abdomen should be opened.

Treatment.—When the cavity of the abdomen is penetrated, place the patient on a bed, carefully examine the wound, and return any viscera that may protrude. If the intestine be wounded, stitches must be applied. Preference is given to Lembert's interrupted suture.

To relieve pain and to arrest peristaltic action, large and repeated doses of opium are called for.

Where there is only a superficial wound, endeavor to procure union by means of sutures.

Laparotomy or **Abdominal Section** is performed either for the removal of foreign bodies from the intestines, for operative procedures, or when acute obstruction exists, in cases of intussusception, or of injuries of the abdominal viscera.

If the weather be cold, the temperature of the apartment, prior to commencing the operation, should be raised to about 70° F. Then the patient having been placed upon his back, his bladder should be emptied, and the anesthetic administered. He is then carefully scrubbed and the field of operation resterilized, the parts thoroughly surrounded by sterile sheets and towels and the instruments arranged for immediate use.

The surgeon makes an incision in the middle line below the umbilicus, or over the seat of obstruction if it can be determined, and carries his knife cautiously down to the peritoneum; this membrane is then carefully seized by hemostats or thumb forceps, making certain that it alone is contained in the hold of the instrument. It is then raised to prevent injury to the bowel and is carefully snipped through with scissors or gently incised. The finger is then passed in and the incision enlarged by cutting with a straight pair of blunt-pointed scissors on the finger in the abdominal cavity. Remember the smaller the opening through the peritoneum the less danger of hernia. Should the intestines protrude they are to be carefully protected by previously counted pads wrung out of hot normal salt solution. If the surgeon suspects some involvement of the intestines he should carefully search for the diseased or injured portion and attempt correction. After operation the intestines should be replaced and this done with the minimum of handling. Closure of the wound is left to the judgment of the surgeon, always remembering, however, that the peritoneum should be closed separately when possible. The stitches may be removed when deemed necessary by the conditions of the case.

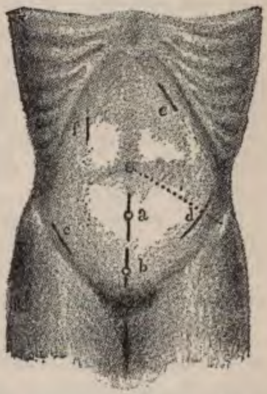


FIG. 34.—Incisional Lines for Reaching Certain Abdominal Organs. (*Walshaw.*) *a*, Laparotomy Ovariotomy; *b*, Suprapubic Cystotomy; *c*, Ligature of External Iliac Artery; *d*, Inguinal Colotomy; *e*, Gastrostomy; *f*, Cholecystotomy.

If the bowel cannot be released, it may be opened as low down as possible, and the aperture stitched to the integument of the abdominal wound, and an artificial anus established.

Appendicitis.—An inflammation of the vermiform appendix of the cæcum. This organ is a frequent seat of inflammatory conditions because of its poor blood supply and situation. It is about four inches in length and its orifice is partially guarded by the valve of Gerlach.

Appendicitis is rare in infants and possesses in them a high mortality. The disease is most common in those of early puberty and the middle aged; rare in the aged and very young.

Symptoms.—The patient at first complains of an obscure pain referred to the lower abdomen. This may pass off or grow progressively worse. The above symptom is generally accompanied by diarrhœa, constipation, flatulence, nausea, vomiting, loss of appetite and a peculiar gastro-intestinal uneasiness referred to the region of the umbilicus. These may be termed the premonitory symptoms. Following the above symptoms there is a rise in temperature to 102° or 103° F. This may follow an initial chill, but not usually so. The pain and tenderness now become more localized over the right iliac fossa unless the organ be long and malposed. McBurney's point, the usual position of the most acute tenderness, is a spot about two inches internal to the anterior superior spine of the ilium, about midway on the line extending from the anterior superior spine to the umbilicus. There is usually marked rigidity of the abdominal walls. This, however, is a sign that may be caused by the constant use of the ice bag and consequently the surgeon must be on his guard. As a rule there is a marked increase in the number of leucocytes.

It may be assumed with certainty that an abscess has ruptured in the abdominal cavity, if the pulse become small and wiry, the temperature below the normal, or extremely high, the pain diffused, with accompanying symptoms of profound shock.

Treatment is divided into medical and surgical. In the incipiency of the attack salines should be administered until free evacuations are produced; the patient should be kept in perfect rest and fed on spoon diet. The application of hot fomentations and turpentine stupes may be beneficial. If there be much nausea or vomiting, morphia may be administered hypodermatically; this should be done only in the direst need because it always greatly masks symptoms and hampers the operator. It would be far better in severe nausea to wash the stomach.

If the diagnosis were always certain from the beginning and if the cases were seen at the very start by a surgeon immediate operation in every case would be eminently proper (DaCosta). Extreme doctrines are seldom tenable and one-sided exclusive practice is never safe (Senn). In view of the fact that from 80 to 85 per cent. of all cases of appendicitis suffer unless operated upon from subsequent attacks it would seem that operative interference is justifiable in a vast majority of cases. The surgeon, however, who belittles medical treatment in all cases is trespassing upon most dangerous ground and should bear in mind that the leaven of conservatism is often wise in his practice.

The diagnosis of appendicitis having been established, the patient should at once be placed upon a diet of liquids and these given only in small quantity. Some advise starving for a day or so. The administration of laxatives early in the disease is generally admitted to be good practice. They, however, should never be given where perforation or other complications exist. The safest laxative is castor oil in tablespoonful doses, given every three hours until the bowels move. Should there be marked symptoms the above treatment is best fortified by thorough emptying of the rectum by an enema.

Operative Treatment.—In all cases where there is reason to believe that pus has not formed, the muscle-splitting operation devised by McBurney is generally given the preference.

An incision is made parallel with the fibers of the external oblique muscle about four inches in length and two inches above Poupart's ligament. The external oblique muscle is exposed and its fibers separated on a line parallel with their course. This exposes the internal oblique whose fibers are also separated as above. The surgeon then enlarges the wound by stretching and the remaining structures are carefully cut through and the peritoneum exposed. This structure is grasped and raised up, being careful not to include any bowel, and a small cut made through it. The omentum generally presents; this, however, can usually be pushed away and the finger inserted into the abdominal cavity. The peritoneal wound can then be enlarged by cutting with blunt-pointed scissors guarded by the finger in the peritoneal cavity. The appendix is then delivered, its mesentery tied off and a cuff of peritoneum dissected back; a ligature passed as close as possible to its base and the remaining portion removed. The stump is then treated with carbolic acid and alcohol. The cuff of peritoneum is then brought over the stump and sutured in place. The stump is then invaginated by Lembert sutures and the abdominal wound closed by suturing the peritoneum and muscular structures together in their respective positions. This operative technique undoubtedly lessens the danger from subsequent hernia through the line of incision. For the many methods of treating the stump of the amputated appendix the student is referred to the text-books.

In all cases where drainage is to be used it is of no advantage to use the so-called gridiron or McBurney technique as above described. In these cases simple incision through the abdominal wall regardless of the direction of muscular fibers is all that is necessary. For all cases of perforating or gangrenous appendicitis associated with pus in the peritoneal cavity subsequent to operation the patient should be put upon the Murphy treatment to facilitate drainage. For details see textbook.

Colotomy.—This operation is performed where there is an invagination of the intestine, where the operation for anastomosis or resection is not practicable, and where stricture of the rectum may render it advisable.

The operation is resorted to in order to establish either a temporary or a permanent fistula. It may be undertaken in either the inguinal or lumbar region.

Lumbar colotomy may be affected either in the right or left loin; the latter being the most common. The mode of performing the operation is practically the same on either side: the patient is prepared in the usual manner; placed upon the side of the body opposite to that to be operated upon; the flanks are to be well supported by means of a sand-bag or hard pillow; an incision is made extending from the edge of the erector spinæ just below the border of the last rib and carried down toward the anterior superior spine; the structures are cut through

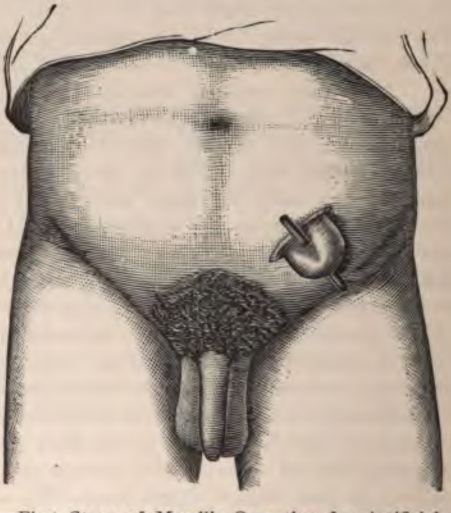


FIG. 35.—First Stage of Maydl's Operation for Artificial Anus. (After *Esmarch.*)

until the transversalis fascia is reached, which is to be carefully divided; the fat which lies over the colon separated, and the gut stitched to the skin. If the symptoms are not urgent the bowel should not be opened until the third day after the operation, so that the parts may have an opportunity to become adherent; if, however, it is necessary to make the opening without delay, fasten it to the skin, protect the parts with gauze pads so that no fecal matter can extravasate into the surrounding tissue, stitch the bowel at the point of opening to the skin and close the upper and lower angle of the wound with silk sutures. Dress with a large antiseptic gauze pad. This operation is rarely given the preference to-day, since inguinal colotomy is more humane.

Left Inguinal Colotomy.—The patient is placed upon his back; the operator makes an incision, commencing one inch to the inner side of the anterior superior spine of the ilium, terminating an inch above and a little external to the center of Poupart's ligament; the structures are divided down to the peritoneum in the usual manner. Arrest all hemorrhage and carefully incise the peritoneum for the length of an inch and a half, and stitch it to the skin. The colon is now to be fastened to the margin of the wound by means of a row of interrupted sutures an eighth of an inch apart; if feasible, wait for three days before opening the bowel. If, however, the symptoms are urgent, proceed with the operation, taking the greatest care not to infect the wound, and at the same time see that the parts are thoroughly irrigated with an antiseptic solution. Dress the wound with an antiseptic pad.

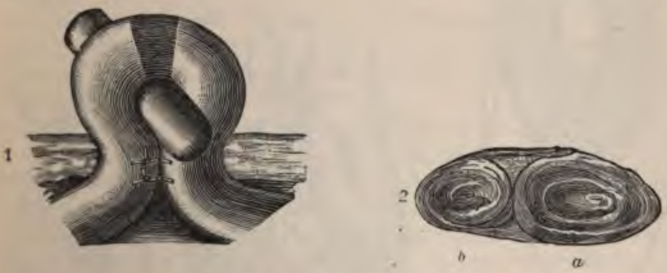
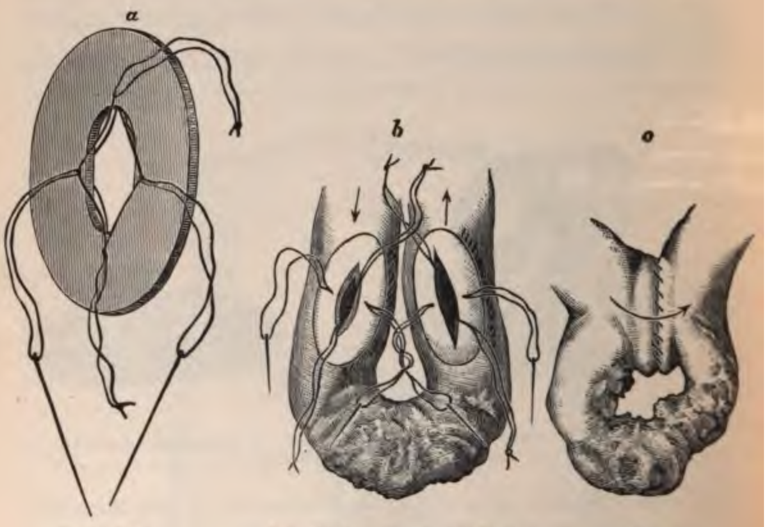


FIG. 36.—1, Intestinal Loop Drawn Forward. 2, Completely Served; *a*, conveying end, *b*, discharging end.

Intestinal Anastomosis is performed in cases of obstruction of the bowels. Its object is to establish a communication above and below the point of obstruction in the intestines.

The portions of gut to be approximated are held in position by means of plates made of decalcified bone, leather, or rings of various patterns devised by Abbé, Brockaw, Matas, and Senn; or the metal button of Dr. Murphy.

The parts of the bowel between which it is desired to establish a communication are brought into the wound and separated from the rest of the intestines by means of sterilized gauze pads; a slit is made in the mesentery above and below the part to be united, and a piece of gauze is passed through this opening and tied over the gut so that no extravasation from the bowel can take place; an incision is made, the length of the greatest diameter of the ring to be used, on the convex surface of the bowel opposite the attachment of the mesentery. The interior of the bowel is now to be thoroughly irrigated with hot distilled water, and the ring put through the wound in the gut and fastened *in place* by means of the four sutures attached to it. The wound in the



Bone Plate. Introducing the Bone Plate. Seam.

FIG. 37.—Intestinal Anastamosis. (*Senn.*)

other portion of the bowel is treated in the same manner, and the openings in the gut fastened by tying together the four sutures of each ring or plate; the parts are again washed and a row of continuous sutures is made at the border of the plates, in order to have a broad approximating surface. The gauze tied above and below the rings is now removed, the intestines returned to the abdomen, the wound closed and dressed in the usual manner.

Perfect rest is to be enjoined; if there be nausea, vomiting, or thirst, very hot water, or small pieces of cracked ice should be administered. Only liquid diet should be allowed for two days after the operation. The bowels should not be disturbed for three days, when an enema should be administered; a teaspoonful of sulphate of magnesia should be prescribed until a movement has been produced. If there be much pain, opium in some form is indicated; it should not be employed if its use can be avoided.

This mode of treatment is to be pursued when the patient is strong enough to stand the operation, and when a more radical procedure is not contraindicated, owing either to the advance of the disease, or to the want of strength of the patient.

In performing the operation every effort must be made to economize time and to prevent shock; an assistant should be detailed to keep the intestines warm by means of cloths wrung out of hot water. If there be evidence of shock, a twentieth-grain dose of strychnia, or a sixtieth of a grain of atropia, together with whisky, should be administered. Intravenous injection of normal salt solution is often useful in overcoming shock.

Renal Calculus or stone in the kidney. There will be pain and uneasiness in the lumbar region, usually just below the twelfth rib; the pain is increased on motion, and at times shoots down the cord to the testicle; frequent desire to micturate will exist, occasionally accompanied by blood, varying in quantity; pyuria will also be present.

Nephroptosis or Movable Kidney.—The kidney may be freely movable behind the peritoneum and devoid of a mesonephron (movable kidney) or it may be within the peritoneal cavity and possessing a mesonephron (floating kidney). The movable is acquired, the floating rare and always congenital. A movable kidney may possess as great a range of mobility as the floating kidney. The condition is more common in women than in men. The right kidney is most commonly affected.

Causes.—Traumatism, it is now believed, rarely produces it. Tight lacing, wasting diseases, pregnancy, strains, a relaxed abdominal wall and uterine displacements produce or are accompanied by movable kidney. Harris in a masterly article believes it to be due to an abnormal relation of the body form.

Symptoms.—These may be absent or of the gravest nature. Usually there is pain in the loin or a dragging sensation. Sudden and violent attacks of nausea and vomiting may come on associated with vertigo, chills and a rise of temperature (Dietl's crises). These symptoms are believed to be due to kinking of the ureter. There may or may not be a palpable tumor that changes its position. Frequent attacks of violent indigestion are often complained of. The patient may become a profound neurasthenic. The flush tank symptom is important.

Diagnosis.—This is arrived at by a summation of the cardinal symptoms and by an examination, revealing a movable tumor.

Kendal Frank's Method.—The patient is recumbent. The examiner stands on the side to be examined. The left hand grasps the loin. The fingers are pressed well in and as far under the margin of the twelfth rib as possible. The thumb is anterior just below the margin of the ribs. Direct the patient to thoroughly relax and take a full breath, after which the thumb is pressed well into the abdomen and the fingers posteriorly in the loin. The lungs are then emptied and the abdominal parietes relaxed. Make pressure below with the right hand and the kidney may be felt if movable, or it may slip back into place between the thumb and fingers of the left hand.

Treatment.—This is carried out by rest in bed and the use of a proper support to retain the organ in position. A tightly fitting corset laced from below upward has been recommended by Gallant.

Nephropexy or Nephrorrhaphy.—Resort to operation when symptoms are urgent and the organ can not be retained by mechanical means. The patient is placed upon the abdomen with a kidney pad or folded pillow beneath the abdomen. Make a vertical incision commencing one half inch below the border of the twelfth rib and carry it downward and outward for three inches along the margin of the erector spinæ and toward the iliac crest. Expose the fatty capsule and thoroughly free the organ preparatory to delivery, which is best accomplished by means of Edebohl's technique. Flex the legs upon the thighs and gently roll the patient downward on the kidney pad. This necessitates abdominal breathing which should bring the kidney into the wound. Then deliver, being careful not to injure the vessels.

Fixation.—The gland may then be fixed in position by suturing or *slinging in gauze* (Senn's operation).

Nephrotomy.—The kidney should be cut down upon in the same manner as described in the operation for nephrorrhaphy; when the kidney is reached, the operator takes it between the finger and thumb to feel if a stone be present; should none be detected a long exploring needle is passed into the kidney in several directions; this means failing, an incision is made through the capsule, the kidney divided by means of a dry dissector, and the operator passes his finger into the pelvis of the kidney and searches for the stone. If one be present it is removed by means of a lithotomy forceps or a scoop; the cavity is then flushed with an antiseptic solution, and afterward packed with iodoform gauze, a drainage tube is inserted and the wound dressed in the usual manner.

Nephrectomy.—Removal of the kidney. This operation is performed where wounds, or rupture of the ureter make it necessary, and in cases of malignant tumors, tuberculosis, multiple abscesses, calculus, pyonephrosis, and hydronephrosis.

The kidney may be removed on lines that have already been laid down when describing other operations involving this organ. When the tumor is very large the kidney is more readily reached by an incision made through the linea alba; or it may be made along the outer edge of the rectus muscle. The peritoneum can be readily detached without making an incision. Unless it be too adherent the capsule should be separated. The gland must be removed from its bed of fat; the ureter tied by a separate ligature, and the stump disinfected. The vessels are to be included in an ordinary pedicle ligature, and the structures divided about half an inch therefrom. Hemorrhage is to be controlled in the usual manner; if it becomes necessary, a hemostatic forceps may be retained in place. Close the wound and dress the patient in the usual manner.

HERNIA.

Hernia is a term used to signify the protrusion of any viscus from its natural cavity, but surgeons generally confine it to protrusions of the viscera from the cavity of the abdomen.

There are many varieties of hernia, depending upon the parts in which they occur, or according to their contents.

Herniæ most frequently make their appearance at the groin, the navel, the labium pudendi, and the upper and fore part of the thigh.

Inguinal hernia is the name when the hernia protrudes at the abdominal ring.

Scrotal hernia, if the parts descend to the scrotum.

Femoral hernia, when it takes place below Poupart's ligament.

Umbilical hernia, when the bowels protrude at the navel.

Ventral hernia, when it occurs at other parts of the abdomen.

Congenital hernia, when the parts have not any proper peritoneal sac, but are contained in the *tunica vaginalis testis.*

From the contents of the hernia, they are said to be either enterocele, epiplocele or entero-epiplocele.

It is *Enterocele,* if a portion of the intestines alone form the contents of the tumor; Epiplocele, of omentum only; Entero-epiplocele, if both intestine and omentum.

Herniæ are said to be:

Reducible, when the protruded bowels admit of being readily returned to the abdomen; *irreducible,* when the protruded bowels suffer no constriction, but cannot be returned to the abdomen, owing to adhesions, or to their large size in relation to the aperture through which they have to pass.

It is *strangulated* when it not only cannot be reduced, but suffers constriction also.

The predisposing causes are deficiencies, or resistance, resulting from relaxation, or malformation; the principal are a preternaturally large size of the openings at which the bowels are likely to protrude; a weakness and relaxation of the margins of these apertures, and a laxity of the peritoneum and mesentery.

The exciting causes are the powerful action of the abdominal muscles and diaphragm, accidental blows, great muscular action, obesity, wearing tight clothes, pregnancy, jumping, etc., etc.

Symptoms.—*Of reducible hernia* are: a swelling at some point of the abdomen, which is subject to change of size, being smaller when the patient lies on his back, and larger when he stands up and holds his breath. It diminishes when pressed, and grows larger when the pressure is removed. Frequently, in consequence of the unnatural condition of the bowels, patients affected with hernia are troubled with colic, constipation, and vomiting.

If the case be one of intestinal hernia, it will be characterized by the uniformity of its surface; it is generally larger when standing up than when lying down; it presents a distinct impulse on coughing; it is tympanitic on percussion; a gurgling noise is often made when the bowel is returning.

If the hernia is *omental*, the tumor is more flabby and has a more unequal feeling; it is generally indolent; it is dull on percussion; the impulse on coughing is fainter; if reduced it returns gradually and without gurgling.

If it is *entero-epiplocele*, the characteristic marks are less clear, being a combination of the symptoms which attend the more simple cases.

The prognosis in reducible hernia is favorable as long as the rupture is of moderate size, can be kept well up by a proper truss, and the patient is not exposed to violent exertion.

Sir Astley Cooper has observed that the danger of hernia is in proportion to the smallness of its size.

A reducible hernia must be returned to the cavity of the abdomen without delay, and as soon as the parts are returned a suitable truss must be put on and worn without intermission.

Irreducible Hernia.—The most frequent causes that prevent the ordinary reduction of hernia are either the largeness of the contents, alteration in its form and texture, adhesion of parts and formation of membranous bands within the sac. If the tumor cannot be returned, and no unpleasant symptoms attend the case, the only thing to be done is to keep the parts in a suspensory bandage, to prevent an increase of the malady, or make use of a truss with a hollowed pad, so as to support and protect the part; or perform the operation for the radical cure of hernia.

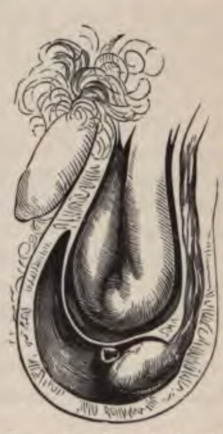


FIG. 38.—Scrotal Hernia.

Strangulated Hernia.—The symptoms of a strangulated hernia are a tumor in the situation of the rupture, attended with pain over the whole abdomen, sickness and inclination to vomit, suppression of stools and some fever. If the reduction be delayed, the vomiting becomes very frequent; all the contents of the stomach, and afterward of the intestines, are ejected. There is great anxiety and restlessness, with cold extremities and a small, quick, and hard pulse. Then hiccough comes on, the pulse is hardly perceptible, respiration weak, and the whole body is covered with a cold, clammy sweat. The protruded viscus now begins to mortify; the patient suddenly becomes easy, the swelling of the belly subsides; the tumor diminishes; the skin sometimes changes to a livid hue; its feeling is emphysematous, and it crepitates on being touched. In this state the gut returns to the abdomen spontaneously, or is readily returned, and the patient fancies himself better. This feeling is, however, of short duration; hiccough and cold sweat increase, convulsive symptoms come on, and the patient soon expires.

The immediate cause of these bad symptoms is the stricture made on the prolapsed part of the gut by the aperture through which it passes; consequently, its removal is the only thing that can bring relief, and this object is to be accomplished by returning the bowel into the abdomen, or dividing the parts which form the stricture.

The remedies generally employed before an operation is resorted to, are taxis, cold applications, the hot bath, 96–100° F., a large dose of opium or morphia.

The Taxis.—The bladder having been emptied, the patient should lie down in an attitude of complete repose, and be put under the influence of chloroform; if this is not used, he should be put in a warm bath, both thighs flexed and placed close to each other, so that every muscle and ligament connected with the abdomen may be relaxed; then the surgeon grasps the lower part of the tumor with the palm of one hand, tenderly compresses it, and with the fingers of the other kneads the parts at the neck of the tumor, occasionally drawing them very gently downward, in order, if possible, to dislodge them. If the tumor be not sensitive, this operation may be continued for half an hour, when the gurgling sound which accompanies the return of the intestines may be heard.

If taxis under the influence of ether fail, the surgeon should proceed to perform the necessary operation.

Having gone through the general treatment of herniæ in their respective stages, they are now to be spoken of specifically.

There are four varieties of abdominal hernia to be described; viz., *inguinal, femoral, umbilical, ventral.*

INGUINAL HERNIA.

There are three kinds of inguinal hernia: the oblique, direct and congenital.

Oblique Inguinal Hernia.—This variety takes the course of the spermatic cord; it begins with the cord as it passes out of the abdomen, and follows the direction of the inguinal canal; its course is oblique, and on this account is so called.

With respect to the parts about the hernial sac; the spermatic cord is behind, the testicle below, the internal oblique and transversalis above, and the fascia transversalis beneath it.

Direct Inguinal Hernia.—In this case the hernia does not follow the course of the spermatic cord, but comes out almost directly through the external abdominal ring, and pushes before it the fascia transversalis. It passes on the *inner side* of the epigastric artery, and directly as it emerges from the ring is received under the fascia of the cord, which forms one covering, and passes into the scrotum.

Direct inguinal hernia may be known from oblique: first, by tracing the spermatic cord, it will be found that the hernia is *behind* the cord, whereas in oblique it is *before* it; secondly, when the mouth of the sac is traced, in oblique hernia, it will be discovered *above* the abdominal ring, toward the spine of the ileum; but in direct hernia, there is an inclination *inward* toward the umbilicus.

CONGENITAL HERNIA.

In this hernia the protruded parts have not any proper peritoneal sac, but are contained in the tunica vaginalis of the testicle, which serves as the hernial sac.

FEMORAL OR CRURAL HERNIA.

The seat of femoral hernia is the upper and fore part of the thigh, the protruded intestine passing out at the same opening through which the large blood-vessels are transmitted to the thigh, and consequently, under Poupart's ligament. It is most frequently met with in women.

The characteristic symptoms of femoral hernia are its situation with respect to inguinal hernia; its capability of reduction with regard to bubo.

UMBILICAL HERNIA.

In this hernia some of the viscera of the abdomen, more frequently omentum, pass out at the umbilicus, through an opening in the linea alba, and, as in other varieties of hernia, are included in a sac formed by the peritoneum.

VENTRAL HERNIA

differs from umbilical in its seat, which is usually at the linea alba, or linea semilunaris; but any visceral protrusions at the anterior or lateral parts of the abdomen, except those already described, may be called ventral hernia.

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Operation.—Having used the means for reduction already pointed out, without success, an operation becomes necessary; taking care not to delay too long.

While the anesthetic is being administered, the skin about the hernia must be shaved and the parts thoroughly cleaned, the whole proceeding to be carried out as described under the head "Aseptic Surgery." The incision varies according to the site of the rupture.

Oblique Inguinal Hernia.—The patient should be placed upon a table; remove the hair; commence the incision from the upper part of the tumor, and carry it along the middle to the lower part. By the first incision the fascia of the cord is laid bare, and in doing this the external pudendal artery, which crosses directly opposite the abdominal ring, is divided; this must be secured; then scratch through the fascia of the cord just below the ring, introduce a director upward to the abdominal ring and inferiorly to the lower part of the swelling, and divide the fascia. The fibers of the cremaster are then brought in view; this covering is somewhat dense and must be opened with care; a director is introduced under it, as far as the fascia of the cord, and it is then divided; when this is done, the hernial sac is exposed; it is of a bluish appearance and semi-transparent, from the fluid it contains. Having laid bare the sac, pinch it and feel distinctly the intestine and omentum within. Raise the sac, to separate it from its contents, and make a small cut into it, in a lateral direction; place the instrument horizontally, to avoid the danger of wounding the intestine. As a rule, if the intestine be included in the sac, fluid escapes as soon as an opening is made. Having opened the sac, a director is to be introduced as far as the abdominal ring, which is then divided; the director is then to be carried into the lower part of the sac, in the same manner. When both omentum and intestine are in the sac, the omentum will be found before, and the intestine behind.

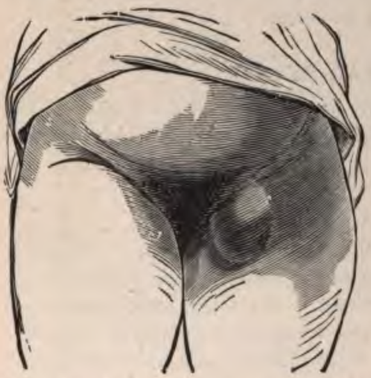


FIG. 39.—Femoral Hernia.

After having opened the sac, next feel for the stricture; put the little in the hernial sac, and ascertain if the stricture is situated at the abdominal ring, and then pass a probe-pointed bistoury, guided on the finger, and divide the stricture, not freely, but to a small extent; a slight motion of the knife will do.

The stricture does not generally exist at the external ring; it is usually situated at the upper part of the hernia, opposite the tendon of the transversalis muscle, or in the sac itself. When this is the case, slit up the abdominal ring, hook up the abdominal muscles and draw them upward toward the abdomen, then pull down the hernial sac; the stricture is thus exposed. Then divide the stricture in the center and *cut directly upward,* let the hernia be where it may, and the danger of

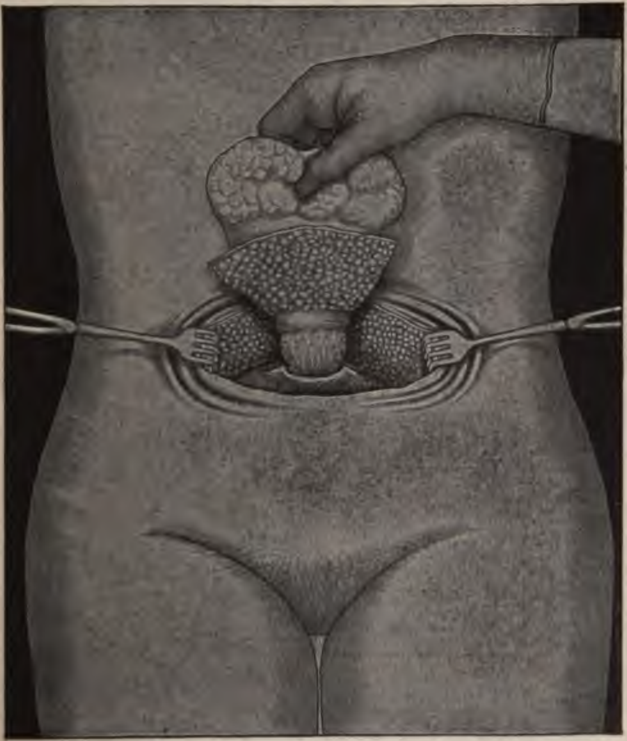


FIG. 40.—Incision and Retractors in Place, Operation for Umbilical Hernia. (*Mayo,* after *Binnie.*)

wounding the epigastric artery will be avoided. The intestine should be returned piecemeal to the cavity of the abdomen, and then the omentum will follow it.

Direct Inguinal Hernia.—In operating on these cases it must be borne in mind that the spermatic cord is placed on the other side; that the hernia is covered by the fascia of the cord, by the cremaster partially, and is contained in a sac, formed by the tendon of the transversalis muscle, assisted by the fascia transversalis, besides a peritoneal sac. The division of the stricture must, therefore, be *directly upward.*

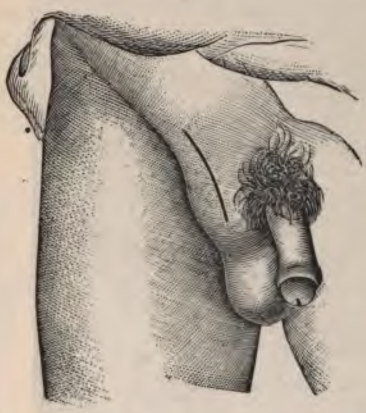


FIG. 41.—Line of Incision in Strangulated Hernia.

Congenital Hernia.—*The seat of stricture* will be usually found under the edge of the transversalis muscle, or at the internal ring, when it should be divided in the same manner as in other cases of hernia.

Femoral Hernia (Fabricius Operation).—Make an incision five inches long, commencing over the pubic spine and parallel to Poupart's ligament. Expose the sac, return its contents to the abdominal cavity, ligate and cut it off, return the stump to the abdominal cavity. Draw down the skin and make an incision through the fascia lata parallel with and below Poupart's ligament. Retract the fascial flap and expose the ring. The crural vessels and fascia should be drawn slightly outward. Free the pectineus muscle and slide it over the orifice of the ring. Pass sutures through the muscle and Poupart's ligament, the lower ones including the periosteum of the bone. When the pectineus is stitched in position it obliterates the femoral canal. The flap of fascia lata and the aponeurosis of the external oblique are united by deep chromicised catgut sutures. Close the skin by interrupted silkworm-gut sutures.

Umbilical Hernia (Mayo's Operation).—Make a transverse elliptical incision around the umbilicus and hernial mass, Fig. 40. Clear the aponeurosis for one and one-half inches around the neck of the sac. Carefully expose the intestine by a circular incision through the fibrous and peritoneal coverings of the sac. Seize the peritoneal margin and if possible free it from the inner lumen of the ring. This greatly facilitates subsequent suture of the peritoneum. Carefully free the intestine from all adhesions and replace them in the abdominal cavity. Any omentum that does not readily return to the abdomen should be removed. If possible have all peritoneal intestinal and omental adhesions completely freed from the ring. The margins of the ring are then overlapped to determine the direction of greatest stretching, Fig. 43. Incise the fibrous and peritoneal coverings of the ring one inch or so on either side and strip the peritoneum from the upper flap. Insert mattress sutures of silver wire or kangaroo tendon one inch above the margin of the upper flap, Fig. 44. These are passed in a similar manner through the lower flap. The peritoneum is brought together by a continuous catgut suture. The sutures in the margins of the ring are drawn taut, the upper flap overlapping the lower. The margin of the upper flap is fixed by catgut sutures to the abdominal aponeurosis and the skin incision closed by interrupted silkworm-gut sutures. After healing has taken place the patient should wear a suitable support.

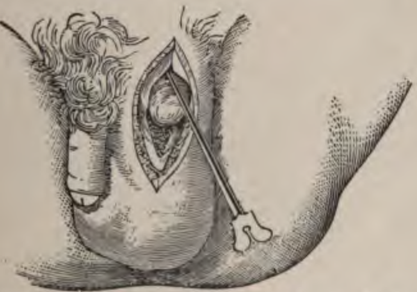


FIG. 42.—Operation for Oblique Inguinal Hernia.

RADICAL CURE OF OBLIQUE INGUINAL HERNIA.

The Bassini Method.—Make an incision parallel to Poupart's ligament and extending from the external abdominal to the internal abdominal ring usually about seven inches long. Expose the sac in the usual manner by careful dissection of the muscles and fascia. Open the sac if necessary. Return the intestine to the abdominal cavity. Carefully separate the spermatic cord from the sac; twist the sac; apply around its neck a stout ligature, and excise all the part in front of the ligature. The spermatic cord is then to be lifted up and the border of the rectus and edge of the internal oblique muscles joined together by suture; the transversalis muscle and fascia are stitched to Poupart's ligament under the cord. The cord itself is placed on this layer of sutures, and the lower border of the external oblique is affixed by suture to Poupart's ligament over the cord, which makes for it a new canal. The skin is then brought together in the usual manner. After convalescence is established the patient should wear a truss for at least

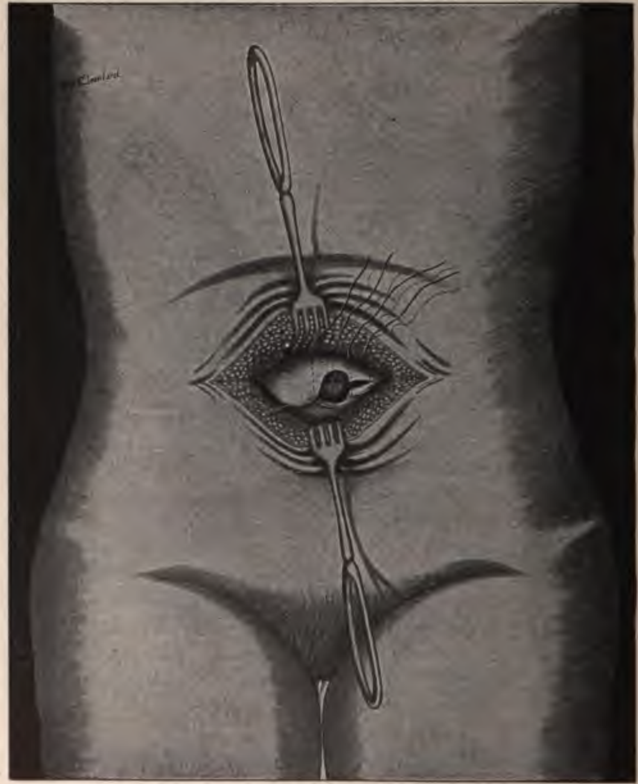


FIG. 43.—Muscles Overlapped and Sutures Placed. (*Mayo*, after *Binnie*.)

six months, by which time the cicatricial tissue will become firm.

For the various methods of operating for the radical cure of other varieties of hernia, the reader is referred to the larger text-books on Surgery.

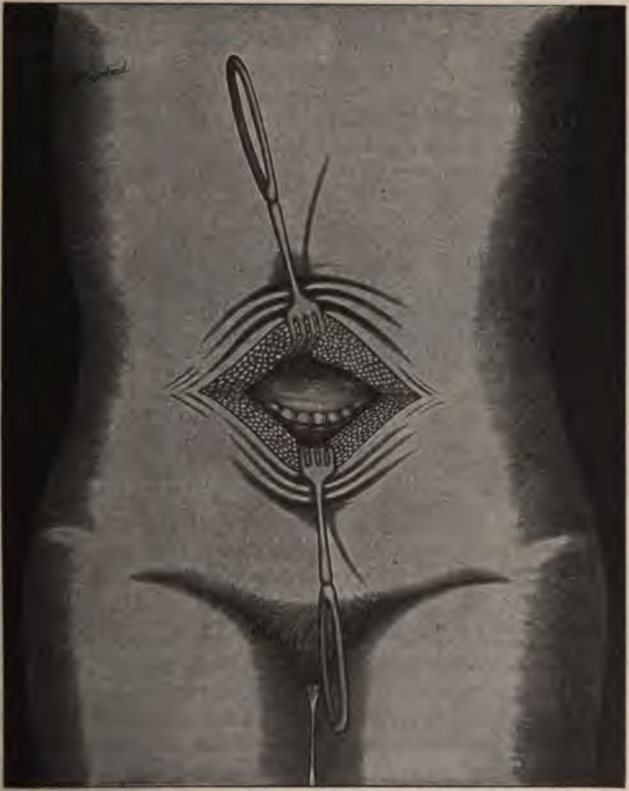


FIG. 44.—Muscles Sutured. (*Binnie*, after *Mayo*.)

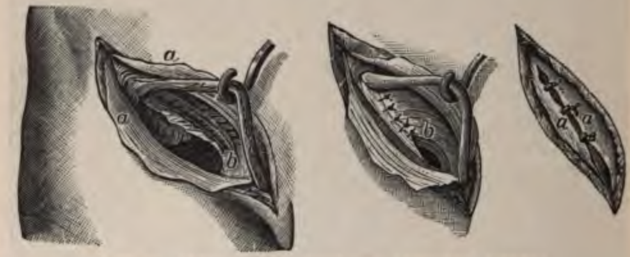
DISLOCATIONS.

A dislocation is the removal of the articulating portion of a bone from that surface to which it is naturally connected.

Symptoms characteristic of dislocation are: An alteration in the form of the joint; an abnormal prominence at one part, and depression at another, with lengthening or shortening; loss of proper motion, and alteration in the axis of the limb, together with sickening pain, numbness, and absence of crepitation.

Before completing the diagnosis the injured should always be compared with the sound joint, and the difference carefully noted.

Causes.—1. The ball and socket joints are most liable to dislocation, from their wide range of movement. 2. Age: Dislocations are more frequent in middle age. 3. Sex: Males are more frequently subjects of this form of injury than females. 4. Previous dislocation of the affected joint. 5. Alteration of the articulation, the result of disease, as the fracture or ulceration of a process of bone. 6. External violence. 7. Muscular action. 8. Elongation of ligaments.



STEPS IN RADICAL OPERATION FOR INGUINAL HERNIA.

FIG. 45.—Pillars Open, the cord held up.

FIG. 46.—Pillars Sutured, the cord held up.

FIG. 47.—The Deep Fascia Closed over the Cord.

Diagnosis.—Dislocation is distinguished from fracture by the absence of crepitus; a dislocated limb is less easily moved than the joint in its natural state; the fractured bone is more freely moved. If a fractured bone is drawn into its normal position, it will resume its distorted shape when the extension is discontinued; if a dislocated bone is drawn into its natural position, it usually remains there. The limb of the fractured bone will most generally be found shortened.

Morbid Anatomy.—Dislocation is attended with rupture of the ligaments and muscles in the neighborhood of the joint. Bones, too, may be fractured and cartilages injured. The ligaments, as a rule, reunite and heal. If the dislocation be not reduced lymph is thrown out around the head of the bone and a new socket is formed, the ligaments becoming lined with a smooth, ivory-like substance, and frequently a degree of motion is acquired. The old socket is gradually filled up. The great vessels sometimes become adherent to the capsule or periosteum of the displaced bones, and fatal hemorrhage may result if attempts are made at reduction.

Treatment.—Dislocations should always be reduced as soon after the accident as possible. Whenever practicable the patient must be put under the influence of an anesthetic, so as to prevent the involuntary resistance of muscles.

The reduction of a dislocation is affected by getting the head of the displaced bone in such a position that the muscles will draw it into its socket; this may be done by *manipulation* and *manœuvring,* and by such movements of flexion, extension and counter-extension, as will bring the bone back into its normal position. Direct force may be used. Extension should be made in such a manner as to relax as many of the opposing muscles as possible; this should be aided by such gentle rotation, extension and counter-extension, as may assist in dislodging the dislocated bone. After reduction, fomentations, and ice to the part, together with purging, may be necessary, to prevent inflammation, and to give the ligaments an opportunity to heal; the joint should be kept at rest for some time.

The different methods of extension and counter extension, with the necessary apparatus and appliances to be used, will be described when treating of particular dislocations.

COMPOUND DISLOCATIONS.

A compound dislocation is one in which there is a wound communicating with the injured joint; it is usually accompanied by severe contusion and laceration of the surrounding textures.

Compound dislocations occur most frequently in the ankle joint; next in the knee and elbow joint.

Compound dislocations are very severe forms of injury, attended with much danger, and are apt to be followed by hemorrhage, acute synovial inflammation, rapid ulceration of the cartilage, abscesses, pyæmia, erysipelas, tetanus, etc.

Inflammation is apt to supervene, which will be followed by suppuration, frequently profuse, often terminating in sloughing and gangrene.

Treatment.—Thoroughly antiseptisize the parts; reduce the dislocation by the most applicable means and suture if possible any torn tendons. Secure free drainage if necessary by a counter opening, place plenty of sterile gauze about the parts to absorb the drainage.

The joint should be immobilized upon a well-fitting properly applied splint. In some cases excision may be necessary. In the very old or where the main vessels and nerves have been injured amputation may be the best course to pursue; rather than subject the individual to long continued suffering.

DISLOCATION OF THE LOWER JAW.

A blow on the chin when the mouth is widely opened will cause this dislocation. Yawning will also produce it.

The condyles are usually displaced forward; posterior dislocation is very rare. The accident is generally bilateral; unilateral luxation is rare.

Symptoms.—Both condyles are advanced between the surface of the temporal bone and zygomatic arch; the mouth is open, and the patient is not able to shut it by pressure made on the chin; the lower teeth are on a line anterior to the upper; the appearance is that of a person yawning; the pain is severe; the saliva is increased and dribbles from the mouth.

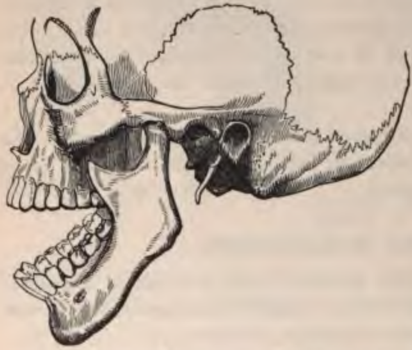


FIG. 48.—Dislocation of the Mandible.

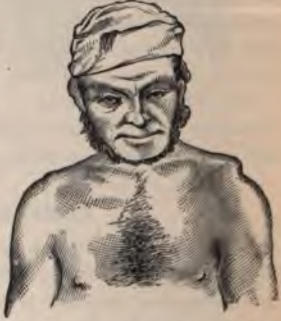


FIG. 49.—Dislocation of the Acromial End of the Clavicle.

If the lower jaw is partially dislocated one condyloid process only advances, while the other remains in the articular cavity.

Reduction.—If recent, this dislocation is reduced by wrapping a handkerchief around the thumbs, placing them on the coronoid processes, and depressing the jaw, force it backward as well as downward, and the bone suddenly slips into its place. If this does not answer, the following method is to be tried: The patient being seated, his head supported by an assistant, the surgeon, standing in front, introduces his thumbs into the mouth, as far back as possible upon the molars, and places the fingers of each hand under the chin and base of the jaw. Using his thumbs as fulcrums, the back part of the jaw is forcibly depressed, to disengage the condyles from the zygomatic fossæ, and at the same moment the chin is elevated by the surgeon's fingers. The thumbs of the operator are to be thoroughly protected by the folds of a handkerchief or napkin. If the dislocation has existed some time, the better plan is to place some yielding substance, like cork, behind the molar teeth, on each side of the mouth, and then raise the chin over them.

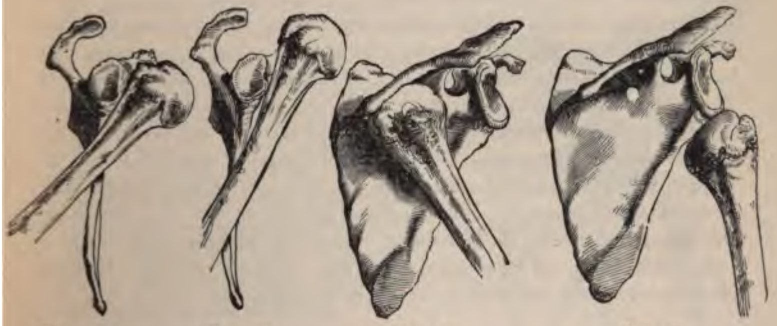


FIG. 50. FIG. 51. FIG. 52. FIG. 53.

Figures Showing Various Dislocations of the Head of the Humerus.

DISLOCATIONS OF THE CLAVICLE.

The sternal end of this bone may be dislocated forward, backward or upward; more frequently forward, when it is thrown upon the upper part of the sternum.

When the dislocation is in front of the sternum, the reduction is easily affected; place your knee against the spine, draw the shoulders backward, and the clavicle will assume its natural position; then apply the clavicle bandage, placing a pad on the displaced end of the bone.

The dislocation behind the sternum is a very rare occurrence; it may be produced by curvature of the spine; if so, there is no mode of reducing it.

The *outer extremity* of the clavicle is most frequently dislocated upward on the acromion; it is, more correctly speaking, a dislocation of the acromion from the clavicle, where the bone is thrown upon the *upper surface* of the acromion, or upon the *anterior part of the spine of the scapulæ.* It is usually caused by violent falls upon the shoulder.

Symptoms.—There is a distinct prominence, formed by the displaced bone, upon the surface of the acromion, which disappears on raising the arm; the limb hangs closely along the trunk, and cannot be raised above the head; the shoulder is somewhat flattened. The facility of reduction, and the prominence of the clavicular portion of the trapezius muscle, indicate the nature of the accident.

Treatment.—Reduction is effected by raising the shoulder, drawing it backward and carrying it outward by placing a pad in the axilla and bringing the elbow well to the side. After reduction, the treatment is the same as for fracture of the clavicle. A thick pad, with the base directed upward, is placed in the axilla, and the arm and forearm must be well secured to the chest; direct pressure must be made by means of a pad and gutta-percha plate laid on the projecting clavicle, and strapped tightly down by a band passing parallel to the arm and under the flexed forearm. This is retained in position by being attached to a strap passed around the opposite axilla. Rhoad's dressing is very strongly advocated by Prof. J. Chalmers DaCosta.

DISLOCATIONS OF THE HUMERUS.

1. **The Subcoracoid Form.**—The head of the bone passes forward, inward and downward, and rests beneath the coracoid process.

Symptoms.—The arm is lengthened; a hollow is felt under the acromion; the shoulder is flattened externally; the elbow sticks out from the side and cannot be made to touch the ribs; the head can be felt in the axilla.

2. **The Subglenoid Form.**—The head of the bone passes downward, forward and inward beneath the glenoid fossæ.

Symptoms.—As above.

3. **Subspinous.**—The head of the bone passes backward, inward and downward beneath the spine of the scapula.

4. **Subclavicular.**—The head of the bone passes forward, inward and upward beneath the clavicle on dorsum scapulæ, beneath the spine, where the head of the bone is readily felt and follows the movement *of the* elbow when located.

Symptoms.—The arm is slightly shortened; elbow projects backward; the acromion seems pointed; the depression of the deltoid is more considerable than in preceding case.

The subcoracoid form is partial; the bone thrown forward against the coracoid process; the *symptoms* are projections of the acromion and a hollow under it, while the head of the bone is prominent in front and may be felt to move on rotating the elbow. If the hand of the injured side is placed upon the sound shoulder, the patient will be unable to bring his elbow to his side, and if the elbow is brought to the side, his hand cannot remain on the shoulder. Three-fourths of all shoulder dislocations are subcoracoid.

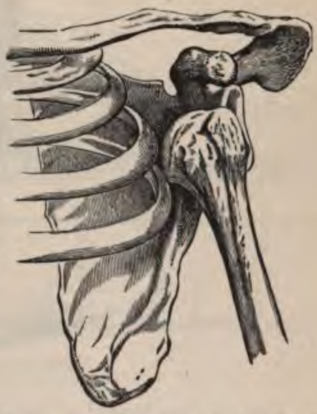


FIG. 54.—Dislocation of the Head of the Humerus Downward.

Treatment.—There are many methods of reducing dislocation of the shoulder: 1. **Simple Extension.**—A towel is passed around the chest, under the arm and crossed above the shoulder, so as to firmly fix the scapula; another towel is fastened around the arm above the elbow; extension is then made with the latter, the patient sitting.

When extension is made for a few minutes, gently roll, shake and lift the head of the bone with the knee.

2. **Heel in the Axilla.**—Professor Brinton prefers the following method: Place a soft pad in the axilla, then make pressure with the heel partially against the pad, and partially against the wall of the chest, pushing the head of the bone upward and outward, and at the same time pulling the limb downward, and a little forward, by means of a towel secured around the arm above the elbow.

3. **Knee in the Axilla.**—The patient is seated in a chair, and the surgeon places one knee in the axilla, resting his foot on the chair. He then puts his hand on the shoulder, to fix the scapula, and with the other depresses the elbow over his knee.

4. **Reduction by the Perpendicular Method.**—Place the patient in a low chair, or on a couch, and raise the arm *perpendicularly by the side of the head,* at the same time fixing the acromion, and mak

gentle traction upward. If little force is required the arm can be taken in one hand, and the acromion can be steadied with the other. Should more force be necessary an assistant may steady the shoulder and the surgeon use his foot, as exemplified in the preceding figure. When the bone is felt to slip into its place the arm must be brought down to the side while the head of the bone is held outward by the hand in the axilla.

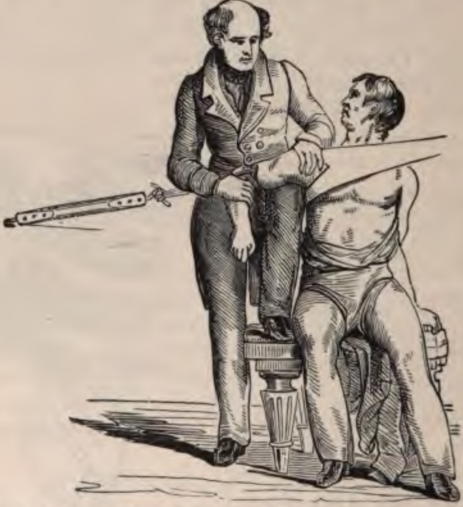


FIG. 55.—One Method of Reduction of Dislocation of the Head of the Humerus (Dangerous).

Kocher's Method.—The forearm is flexed upon the arm, then turned outward as far away from the chest as possible; the elbow is then carried well forward and upward. Rotate the arm inward and lower the elbow, when the head of the bone will probably fall into place. This manipulation may be employed without resorting to an anesthetic.

The extension used in any dislocation *forward* must be made in a direction downward and backward. For dislocation backward the extension must be made forward.

After reduction a small pad should be placed in the axilla, and the arm and shoulder supported for some days with a sling, and a roller *to confine* the arm to the trunk.

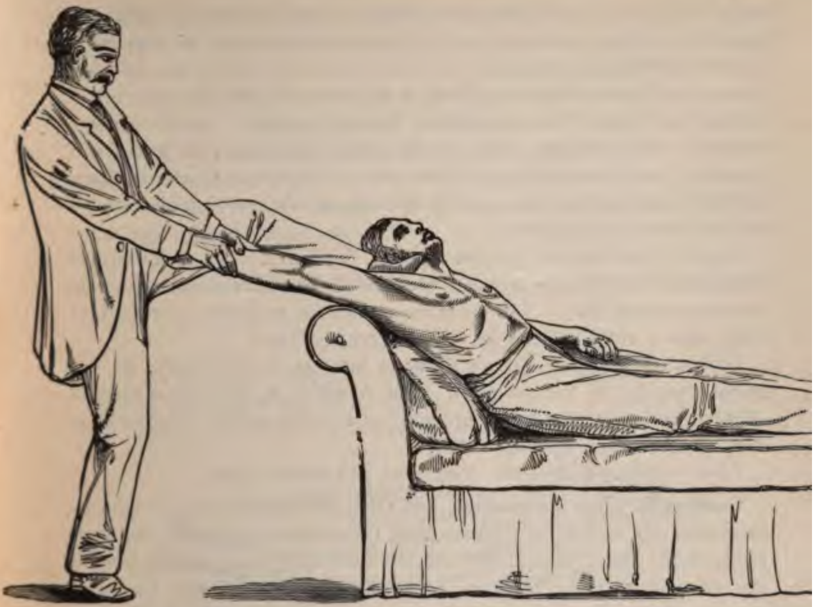


Fig. 56.—Perpendicular Reduction.

DISLOCATIONS OF THE ELBOW.

The elbow may be dislocated in five directions.

First. Both bones, backward, strongly marked by alterations in the form of the joint and loss of motion; there is considerable projection

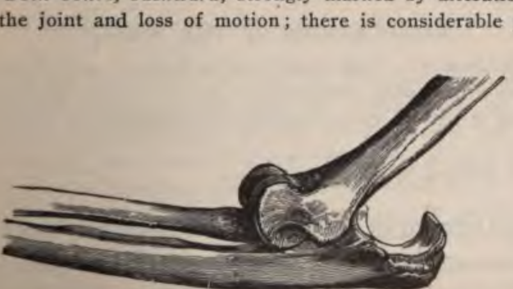


Fig. 57.—Dislocation of the Ulna Backward.

formed posteriorly by the ulna and radius; on each side of the olecranon there is a hollow; the hand and forearm are in a state of supination and cannot be turned prone.

Second. Lateral dislocation of both bones of the forearm; ulna thrown on either the external or internal condyle. There is great distortion and increased width of the joint; the forearm is flexed and pronated. In dislocation outward the radius forms a prominent swelling, and in dislocation inward there is marked and elongated projection on the inner side of the joint.

Third. The third dislocation is ulna backward. The deformity is very great; the forearm and arm are twisted inward, and the olecranon projects considerably. The forearm cannot be extended, nor bent to more than a right angle.

Fourth. The radius thrown forward into the hollow above the external condyle of the humerus. The forearm in this dislocation is slightly bent, but cannot be brought to a right angle. The hand is between pronation and supination.

Fifth. Radius backward. Very rare and seldom seen.

Treatment.—The first, second, and third dislocations may be reduced by seating the patient on a chair; then take hold of his wrist; put your knee on the inner side of the elbow joint; bend the forearm, and at the same time make pressure upon the dislocated bones, so as to separate the coronoid process of the ulna from the posterior fossa of the humerus. While the pressure is kept up by the knee, the arm is forcibly and gradually bent, and the bones will slip into their places.

In the fourth dislocation the hand should be turned supine, the forearm should be bent, and extension made from the hand, without including the ulna.

DISLOCATIONS OF THE WRIST

are of three kinds, viz.: both bones; radius forward; and the ulna backward. They are readily distinguished by the altered position of the hand, which is thrown either backward or forward, or twisted on its axis.

They are reduced by simple extension.

DISLOCATIONS OF THE FINGERS AND TOES.

These are accidents of rare occurrence. When dislocations of the fingers take place they are generally found between the first and second *phalanges.*

The diagnosis is easy when the dislocation occurs at this place; there is a projection of the first phalanx backward, while the head of the second phalanx can be felt on the fore part, though less distinctly.

If the dislocation has occurred within a few hours of the surgeon's seeing it, as a rule, it can be readily reduced; but if it has been neglected, the reduction can only be accompanied by long-continued and steady extension.

After reduction, the finger should be rolled with tape, surrounded and supported with pasteboard; the hand and forearm should be kept in a sling.

It is more difficult to reduce dislocations of the toes than the fingers.

DISLOCATIONS OF THE THUMB.

In dislocation of the first phalanx of the thumb, it will be found thrown back upon the metacarpal bone, where it forms a projection; the lower part of the metacarpal bone projects inward; the thumb is shortened and can neither be bent nor extended; the last phalanx is usually flexed. Ether should always be administered for the manipulations are both painful and difficult for the reason that the head of the metacarpal bone usually buttonholes the flexor muscles.

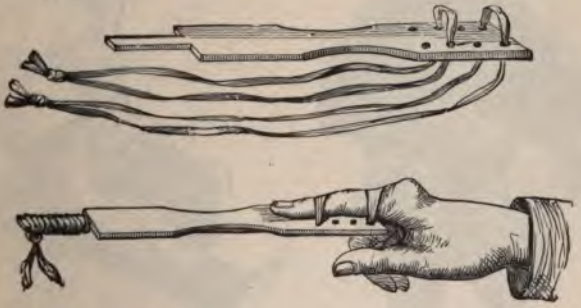


FIG. 58.—Reduction of Dislocated Index Finger and Apparatus for Same.

Extension and counter-extension are the usual means employed to reduce this dislocation. Extension may be made by means of the clove hitch, secured over a wet cloth, and counter-extension with a strong cloth, the fold resting on the palm of the hand, and the ends crossed behind the wrist and brought around to the front of the forearm, and held by an assistant. Should more powerful extension be required, it may be obtained by means of Charriere's forceps or Levis's apparatus. The method of Professor Crosby, which consists in pushing the phalanx back until it stands perpendicularly on the metacarpal bones, frequently succeeds when other modes fail.

DISLOCATIONS OF THE HIP JOINT.

There are four dislocations of the thigh bone; viz., *upward and backward on the dorsum of the ilium; downward into the obturator forearm; backward* and *upward* into the sciatic notch; and *inward* and *upward* on the body of the pubis.

First. Upward, on the *dorsum of the ilium,* happens more frequently than any other dislocation of the hip joint; comprising 50 per cent. of all hip dislocations.

The characteristic symptoms are, a difference in the length of the limb, a change of position inward, a diminution of motion, and flattening. The toes rest upon the tarsus of the opposite foot; the knee and foot are turned *inward;* the knee slightly advanced on the other; the limb an inch and a half to two inches and a half *shorter* than the other, and the legs cannot be separated.

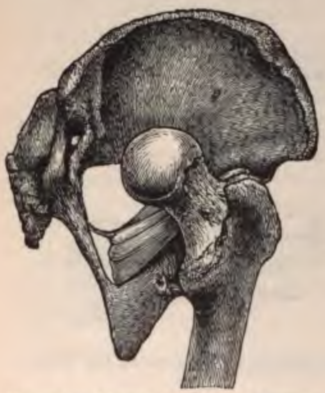


FIG. 59.—Dislocation on the Dorsum of the Ilium.

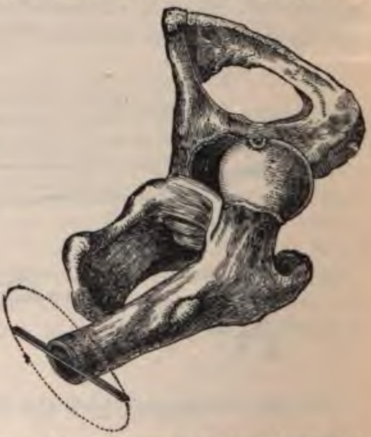


FIG. 60.—Dislocation Backward into the Sciatic Notch.

Second. Dislocation downward, into the obturator foramen. The dislocated limb is two inches longer than the other. In thin persons *the head of the* thigh bone can be felt on pressure. There is flattening of the hip, and the body is bent forward. The toes point to the ground; the foot is *turned outward or inward*. The great trochanter is below Nélaton's line and the gluteal crease is lowered. The body is bent forward.

Third. Backward, into the sciatic notch. The head of the bone is placed on the pyriformis muscle. The limb is from half an inch to an inch *shorter* than the other; the toe rests on the ball of the great toe on the opposite foot. The knee and foot are turned *inward;* the toe, but not the heel, touches the ground when standing. Very little flexion and rotation can be made.

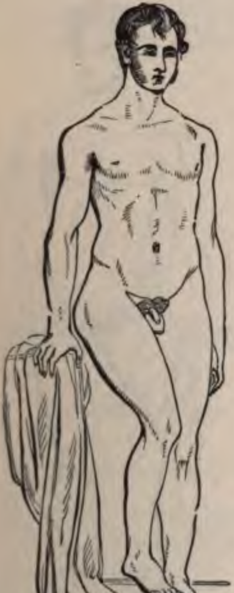


FIG. 61.—Dislocation Upward on the Dorsum of the Ilium.

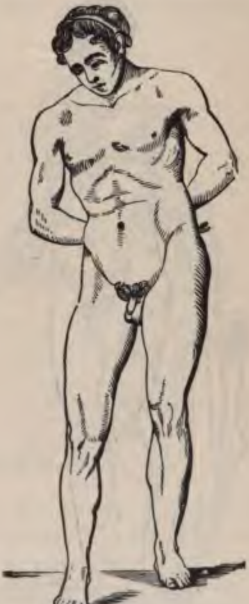


FIG. 62.—Dislocation Downward into the Thyroid Foramen.

Fourth. Dislocation *on the pubes.* The limb is shorter than the other; the knee and foot are turned *outward,* and cannot be rotated inward; the head of the thigh bones is readily felt on the pubes.

Treatment.—These dislocations may be reduced by manipulation or by force; the former is the plan most in vogue.

1. **Dislocation Upward.**—The manœuvre by which a dislocated hip can be reduced consists in employing the length of the limb as a lever and the trochanter as a fulcrum by which the head may be got into such a position as to slip into its socket. The knee must be flexed on the thigh, and the thigh on the pelvis; the surgeon then, grasping the ankle with one hand and the knee with the other, causes the thigh to perform a circumduction movement toward abduction, finishing with a rotatory movement of the femoral axis, when the head of the bone will probably slip into its place.

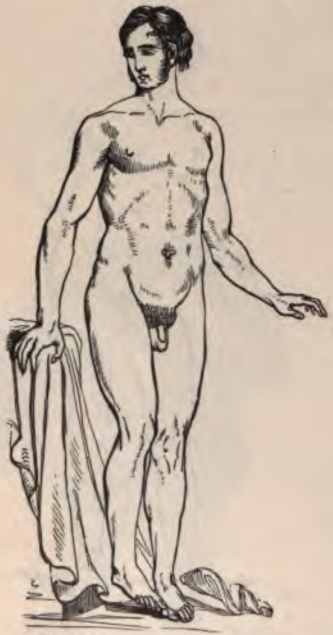


FIG. 63.—Dislocation Backward into the Sciatic Notch.

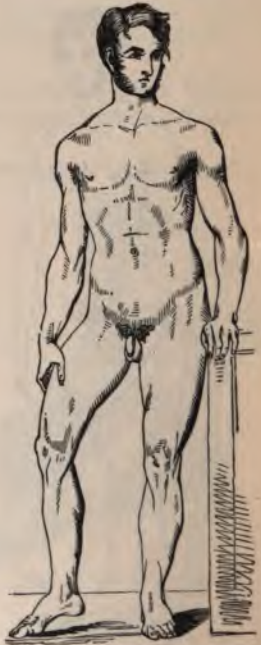


FIG. 64.—Dislocation on the Pubes.

Professor Bigelow recommends that the thigh be first flexed with a little inward rotation, producing inversion of the toes, and then the thigh should be abducted, circumducted, and at the same time rotated outward. This has been described by Pick as bend up, roll out, turn out and extend.

2. **Dislocation Downward.**—Give ether and try to reduce by manipulation. Flex the leg upon the thigh and the thigh upon the pelvis. Place the limb in abduction; do internal circumduction and extension.

3. **Dislocation Backward.**—The symptoms and signs of backward dislocation are similar to dislocation on the dorsum of the ilium excepting that they are not so decided. Treat the same as the backward dislocation on the dorsum of the ilium.

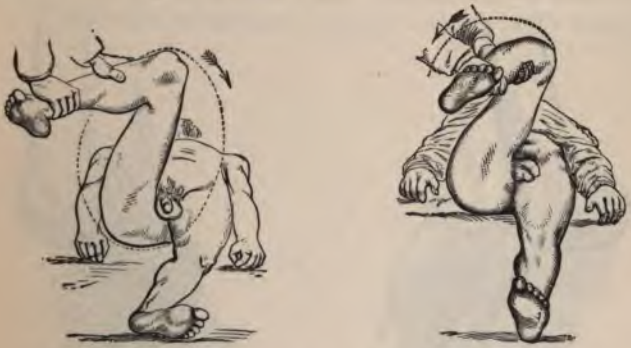


FIG. 65. FIG. 66.

Manipulation for Reduction of Dislocation of the Hip.

4. **Dislocation on the Pubis.**—Etherize, and attempt reduction by manipulations similar to those for thyroid dislocation. Extension may be tried if manipulation fails. It should be in a backward and outward direction; after a little time the head of the bone should be lifted over the acetabulum. This is greatly facilitated by means of a napkin passed around the hip.

The sciatic nerve may be caught over the neck of the femur and so complicate as to prevent reduction. This accident causes great pain and often makes reduction quite impossible without the intervention of the knife. Dr. Oscar Allis's plan of reduction is as follows: Fix the patient upon his back to a board upon the floor, extend the thigh; flex the leg upon the thigh, turn the limb outward to a horizontal position; shake, shock, abduct and adduct, then rotate without flexing the leg. As a last resort, incise and disengage the nerve.

For a full account of these different modes of applying the necessary counter-extending bands, etc., the student is referred to the larger works on Surgery.

DISLOCATIONS OF PATELLA.

The patella may be dislocated outward, inward and edgewise. DaCosta terms the so-called upward dislocation a rupture of the ligamentum patellæ.

It is most frequently thrown on the *external* condyle, and there produces a great projection; the dislocation on the *inner* condyle is less frequent; in dislocation of the patella upward, the ligamentum patella is torn through and the patella is drawn up.

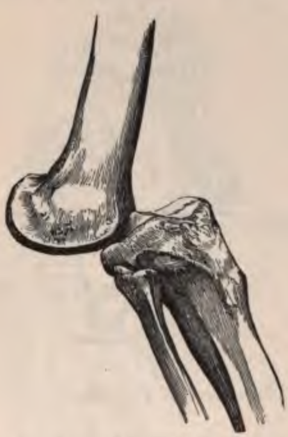


FIG. 67.—Dislocation Forward.

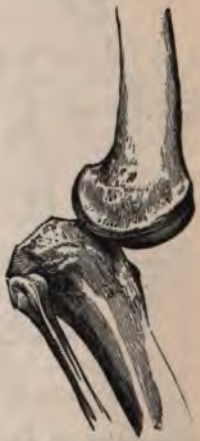


FIG. 68.—Dislocation Backward.

Treatment.—In the reduction of the two first dislocations, the patient is to be placed in the recumbent position the leg raised by lifting it at the heel, and then press on the edge of the bone that is furthest from the articulation. Evaporating lotions are to be employed when the reduction is accomplished, and a bandage should be worn for a few days.

DISLOCATIONS OF THE KNEE.

There are four dislocations of the knee:

First dislocation is *inward;* the tibia projects on the inner side of the joint, and the condyle of the femur rests on the external semilunar cartilage.

The *second dislocation* is where the tibia is thrown on the *outer* side of the joint; the condyle of the femur being placed on the inner semilunar cartilage.

In the *third dislocation* the tibia is dislocated forward.

The *fourth dislocation* is when the tibia is dislocated backward.

The symptoms in these cases are obvious, and the injuries are easily recognized.

Reduction.—Each of these dislocations may be reduced by simple *extension.* There is a great tendency to inflammation in these injuries, for which proper antiphlogistic remedies must be used; perfect rest must be enjoined; iced water, or lead water and laudanum, and such like measures must be resorted to; leeches applied, if necessary.

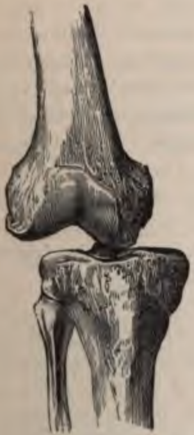


Fig. 69.—Dislocation Inward.

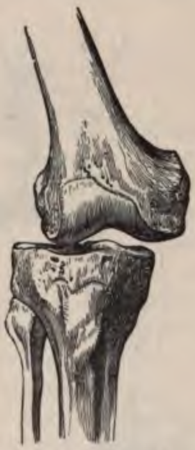


Fig. 70.—Dislocation Outward.

Dislocation of the Semilunar Cartilages of the Knee Joint.—This is often termed subluxation of the knee joint. This injury is generally caused by sudden twists of the joint while in partial flexion; the inner cartilage is most frequently involved.

Symptoms.—Great pain in the knee often causing the patient to fall, fixation of the joint in semiflexion. The surgeon may feel the margin of the dislocated cartilage. The leg cannot be extended without the most severe pain. There is great tendency to inflammation of the joint that must be carefully guarded against.

Treatment.—Anesthetize and attempt reduction by forced flexion and external rotation; an assistant attempts to push back any projecting cartilage. Passive motion must be begun in two weeks and the individual instructed to wear a proper knee support.

DISLOCATION OF THE ANKLE JOINT.

The usual dislocations at this joint are *inward, outward, forward, backward* and *upward,* fracture is usually associated with dislocation of the ankle.

The dislocation *inward* is the most frequent; the foot is thrown *outward* and its inner edge rests upon the ground; the internal malleolus projects against the integuments. The foot rotates easily.

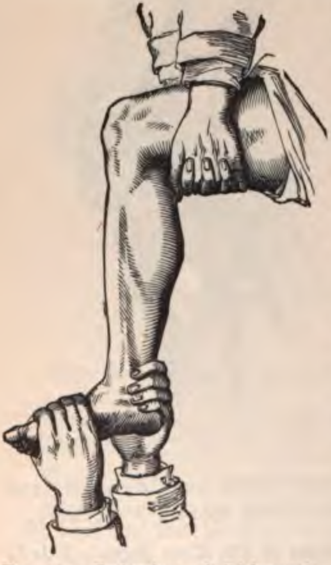


FIG. 71.—Reduction of Dislocated Ankle Joint.

The dislocation *outward* is the most dangerous; the foot is thrown *inward.* The malleolus projects very much. The toes and foot are pointed downward. This dislocation is accompanied by fracture of the internal malleolus.

In dislocation *forward,* the foot appears *shortened* and fixed, and the toes are pointed to the ground; the lower end of the tibia forms a hard swelling on the middle tarsus; the heel appears lengthened. In dislocation *backward* there is shortening of the foot; the bones of the leg project anteriorly. The heel is prominent and the normal relation between the malleoli is altered.

Upward dislocation is very rare and usually associated with fracture. The foot is widened and flattened. The internal and external malleolus are on a level with the sole of the foot.

nt.—To reduce the dislocation *inward,* place the patient on a mattress, bend the leg at right angles to the thigh, let an assistant grasp the foot and gradually draw it in a line with the leg. At the same time, fix the thigh and press the tibia downward. After reduction, support the foot with a many-tailed bandage, keep parts cool, etc.

For dislocation *outward,* reduce the dislocation as above directed, then lay the limb on the outer side, resting it in splints with foot-pieces.

In dislocation *forward* or *backward,* the treatment must be followed by rest. In five weeks the patient may be allowed to get up and use passive motion.

The *upward* or Nélaton's dislocation is reduced by powerful extension and counter-extension. The joint should be immobilized to limit inflammation.

FRACTURES.

A **Fracture** is the division of a bone into one or more pieces, from violence.

A fracture is *simple* when there is no wound communicating with it; *compound* when there is such a wound; *transverse* when the line of fracture lies across the bone; *oblique* when it slopes; *longitudinal* when it is more or less parallel to the long axis; *comminuted* when broken in several fragments; *complicated* when there is laceration of an artery or joint, or other additional injury. A "*green stick,*" or "*willow*" fracture, is an incomplete fracture, in which some of the bony fibers have given way and the rest are bent, but have not broken. It is a fracture of the young. An *impacted* fracture is one in which one fragment is driven into and fixed in the other.

When occurring in the neighborhood of a joint, the terms *intra-capsular* and *extra-capsular* are used, as the line of fracture is internal or external to the capsular ligament.

If the same bone is broken at two different places, or more than one bone is broken in the same limb, it is called a *multiple* fracture. If cracked only, without displacement or separation of periosteum, it is called a fissure.

The circumstances that render bones more liable than usual to be broken are atrophy arising from old age, or from prolonged disease of a limb; certain diseases, as fatty degeneration, rickets, *mollities, ossium,* syphilis, and cancer; original conformation; the bones of some people being more delicate than others.

EPIPHYSEAL SEPARATION

is met with in infants and young persons, before ossification is completed. It most frequently occurs at the extremities of the humerus, radius, femur, and tabia. The ossifying end of the long bone, with the layer of connecting cartilage, is detached. There is great danger of suppuration; the periosteum being stripped from the shaft of the bone. The displacement is sometimes very great and reduction is difficult; it is frequently followed by diminished growth, shortening, deformity, and impairment of movement. It is not unfrequently met with in infants who are the subjects of hereditary syphilis, or those who are suffering from acute rickets or infantile scurvy.

The most common cause of this affection is a wrench of the part, violent traction, or a severe fall.

The symptoms are those of fracture. In the young subject its existence may be suspected when the ends of the fragments are transverse, or nearly so; when the lower fragment retains its position, while the upper moves about; and when the crepitation produced by rubbing the ends of the fragments together is of an unusually dull, rough, grating character. In young persons union takes place promptly.

SIGNS OF FRACTURE.

Signs of fracture are *Deformity, Mobility, Crepitus, Loss of Function, Pain, Discoloration,* and *Disordered Sensibility.*

1. **Deformity** may exist in *length, rotation,* and *angularity; shortening* is produced by muscular action, and is the most common form of displacement; it may be so slight as to require careful measurement for its detection. *Rotation* is usually external, and is caused by the weight of the limb. *Angularity* is the worst form of deformity: the principal indication for treatment is to overcome deformity.

2. **Mobility** in an abnormal position is a frequent sign of fracture. Care must be taken not to confound the mobility of a fracture with the normal action of a joint.

3. **Crepitus** is the most decisive sign of fracture; in a broken bone it is a rude and rough sound, which can be both felt and heard. Do not mistake the crepitus arising from a fractured bone, and that produced by a roughened cartilage, or the inflamed theca of a tendon. Crepitus cannot be obtained in impacted fractures, nor after the formation [illegible] or the rounding of the ends of a bone.

4. **Loss of function** is an important, but by no means an infallible sign.

5. **Pain** is always present to a greater or less degree; it is severe, concentrated, and localized.

6. **Discoloration** is of two kinds: *immediate* and *secondary*. The first is the result of injury to the subcutaneous veins, and frequently involves the entire limb; the second appears several days after the injury, and proceeds from the blood-vessels that surround the fractured bone; it is an important sign of fracture.

7. **Disordered sensibility** frequently exists; there may be tingling in the parts from pressure on nerves.

REPAIR OF FRACTURE.

The first result of a fracture is an effusion of blood between and around the broken ends; then follows a period of exudation, in which plastic lymph and leucocytes are effused; after this the lymph is developed first into fibrous tissue, interspersed with osteoblastic or cartilage cells, and then into bone. The periosteum, medullary membrane, and surfaces of the broken bone are the principal agents in the production of the bone-forming cells. The time required for the completion of the union of broken bone varies from four to ten weeks; being less in the young and healthy. The last stage in the process of repair is the absorption of superfluous bone, and the restoration of the cancelli and medullary cavities. This is completed in from six to twelve months.

The material by which fractures are first united is called *callous*.

The neck of the thigh bone, the olecranon, the acromion, coracoid and coronoid processes, the tuberosity of the os calcis, and the patella do not, as a rule, unite by bone. The reasons given for this are, 1st, the great difficulty in keeping these broken surfaces in contact; 2d, in bones that enter into the formation of joints contact is prevented by the displacement and separation caused by the abundant effusion of synovial fluid into the joint and between the broken surfaces of bone.

If considerable portions of the skull be removed the gap is not entirely filled up.

GENERAL TREATMENT OF FRACTURES.

The sooner reduction is accomplished the better; there is then less swelling and sensibility, the muscles have not had time to be i-
tated, and the diagnosis is more plain. Should swelling
place before the patient has been seen by the surgeon, plac

a comfortable position, and let it so remain until the swelling has subsided.

To get the fragments in position employ extension, counter-extension, and coaptation. Apply extension to the distal extremity by steady, continual traction. Counter-extension is the force employed to counteract the extending force. Do not grasp the part immediately beyond the seat of fracture, otherwise muscular resistance will take place. Coaptation is the pressing of the ends of bones into position.

To keep the parts in position it is often necessary to keep up extension and counter-extension after adjustment. The different articles used for dressings are: *Thin Board* (⅓ inch) of pine or poplar; *Binder's Board,* which gives sufficient support and can be readily moulded by soaking in hot water; flannel saturated with glue and plaster; unoiled leather; sheet rubber, tin, or copper.

The Plaster Dressing consists of crinoline bandages, rolled up loosely in plaster, placed in water until thoroughly wet, and then squeezed dry as possible. Protect the limb with plenty of cotton and then apply the bandage.

A fracture should be disturbed as little as possible, but it should be thoroughly examined on the second and third day. When the swelling has subsided the bandages should be tightened; after which the patient should be seen daily.

UNUNITED FRACTURES.

These may result from constitutional or local causes; the constitutional causes are many, such as typhoid fever, delirium tremens, scurvy, pregnancy, lactation and shock, which is a very frequent constitutional cause. The *local* causes are too much handling, or otherwise disturbing the fragments; too light, or too loose dressing; interposition of a foreign body between the fragments; necrosis.

The treatment of an ununited fracture consists in creating irritation about the fragments, so as to invite blood to the part and encourage the formation of a new deposit of callous.

There are a variety of methods recommended: 1st, by rubbing the fragments together and then treating the limb as in primary fracture. 2d, Brainerd's method, which is the subcutaneous introduction of an awl-shaped drill, perforating the bone from one fragment to the other; several perforations of the bone are to be made, but only one external opening. 3d, The introduction of acu-puncture needles, and the passage of an [illegible] current through them. 4th, Drilling the fragments together with a gimlet, and allowing it to remain in the bone from one to four weeks. 5th Excision of the ends of the bone. 6th, Applying a plaster dressing, or Smith's splint, and putting the patient on his feet with crutches, when attrition takes place, and irritation is effected. 7th, By exposing the free ends of the bones and wiring after sawing off the old stump.

The simplest method should be first tried.

FRACTURES OF THE UPPER JAW.

The superior maxilla is seldom broken unless great and direct violence has been employed; its fracture is generally accompanied by external wound, as in gunshot injuries or a kick from a horse. The fracture is often comminuted and is sometimes attended with concussion of the brain, or with fracture of other bones of the face; it is often produced by force transmitted from the malar bone, the latter remaining sound.

The superior maxilla possesses extraordinary reparative powers.

Treatment.—Preserve and replace all fragments and splinters, the tendency to heal being very great.

The patient must avoid chewing any hard substances until the detached fragment has become attached to the bone. When the alveolar process is broken into two or more fragments, the pieces must be pressed into place and the jaws closed, so that the lower jaw may serve as a support. To maintain apposition apply a Barton or Gibson bandage. It may be necessary to apply fine wire to the teeth, if displacement continues; or an interdental splint composed of vulcanite may be used. Loosened teeth must be pressed into their places and retained by metal caps and bars.

Should the nasal process be broken, a director should be applied through the nose to elevate any depression that may exist.

FRACTURE OF THE ZYGOMATIC ARCH.

This accident is rare, and is produced by direct violence, usually occurring on the temporal side of the suture.

The signs of this fracture are an irregular projection or depression of the fragments with rapid swelling of the parts. The displacement will occur either outward or inward.

There will be neither motion nor crepitus.

Treatment.—Should there be no displacement, apply an anodyne lotion, and keep the parts quiet with a Gibson or Barton roller.

If there be outward displacement, the fragments may be adjusted by pressure on the projecting angle, afterward applying a soothing lotion. If the displacement is occasioned by depression of the malar bone, it will be adjusted by restoration of that bone to its proper position, which requires extensive manipulation. The question of surgical interference must depend upon the urgency of the symptoms.

FRACTURES OF THE NASAL BONES.

The nasal bones are, from their situation, much exposed to fracture.

Signs.—Before swelling supervenes, the appearance of the nose will likely be characteristic of the injury; there will be displacement and *mobility* of the fragments, with crepitation when held lightly by the fingers. Hemorrhage from the nose is apt to be persistent and more or less profuse; if the injury extend to the lachrymal bone, there will be profuse discharge of tears. Symptoms of concussion may accompany the fracture.

Treatment.—If there be no displacement of the bones, cold applications of lead water and laudanum or other soothing lotion will be all that is necessary.

Should displacement exist, the bones must be adjusted by manipulation, assisted by a ring-handled forceps, metallic sound, female catheter, or some other such article, passed into the nostrils; using it as a lever, the fragments are pushed outward while the parts are manipulated with the left hand.

Persistent hemorrhage must be controlled by plugging the nares anteriorly and posteriorly.

As a rule, the fractured bones will retain their situation without further assistance; if they do not, they may be supported by the introduction of oiled lint or iodoform gauze.

If the fracture be compound, loose splinters detached from the periosteum should be gently removed.

Leeches, purgatives, and cold lotions may be necessary to relieve swelling, bleeding from the nose, ecchymosis and headache.

FRACTURES OF THE LOWER JAW.

The lower jaw may be fractured at the symphyses; through the body to one side of the symphysis; through the angle; at the coronoid *process;* or at the neck of the condyle.

The most common site of fracture is the body of the maxilla, toward its anterior extremity.

The condyle, neck, and coronoid process are seldom broken.

This injury is caused by direct blows; falls on the chin; gunshot wounds; kicks from a horse; or in extracting teeth.

Sometimes these fractures are double.

Symptoms.—Great mobility of the fragments, pain, swelling, crepitus, inability to use or move the lower jaw; irregularity of the teeth and of the line of the jaw; dribbling of the saliva;. inability to speak; laceration of the gums and mucous membrane, accompanied with bleeding; the teeth loosened at the point of fracture. The crepitus is felt on moving the chin with the hand placed on the posterior fragment.

The displacement is greater when the fracture is near the symphysis; if on one side only of the middle line, the smaller fragment is liable to be drawn outward and forward. When the angle or ramus is the seat of fracture there is little or no deformity, but crepitus is perceptible to the patient. When the neck of the condyle is broken, there is marked displacement upward, inward, and forward by the action of the pterygoid, the chin being turned *toward* the affected side; in *dislocation* it is *turned away from it.*

Treatment.—It may be necessary to wire the teeth together, in order to retain the fragments in proper position. A piece of pasteboard or gutta percha, cut into proper shape and softened in boiling water, must be accurately fitted to the jaw. Then a four-tailed bandage must be applied, or a Barton or Gibson bandage, at the option of the surgeon. The hard rubber interdental splint serves (when properly made) very well to retain the parts in proper alignment. Wiring by means of heavy silver wire is a most useful and proper surgical procedure when the fragments can not be held by other suitable means.

In fracture at the junction of the body and the ramus of the inferior maxillary bone, a pad is to be placed back of the angle and a crossed angle bandage applied.

During the cure the patient must be kept quiet and fed upon spoon diet, which should be continued until the bone is firmly united. Broths, soups, jellies, tea, milk, etc., are the most eligible.

FRACTURES OF THE CLAVICLE.

A Fracture of the Clavicle is usually caused by indirect violence, such as falls on the arm or shoulder; it is generally oblique in direction; it may be caused by direct violence, when it is commonly seated near the acromial extremity. This bone is more often fractured than any other.

Symptoms.—The shoulder sinks *downward, forward* and *inward;* the distance from the acromion to the sternum is less on the injured than on the sound side. In consequence of the sinking of the shoulder and the outer fragment, the sternal portion of the bone projects over the fractured extremity, and it may be distinctly felt by tracing the usual course of the clavicle with the finger.

Treatment.—A fractured clavicle is easily reduced, but the difficulty is to retain the broken ends in exact apposition.

The arms and shoulders of the patient are to be firmly drawn backward by an assistant, when the fractured extremities come in apposition; the shoulders must be raised and supported in a direction *upward, backward*, and *outward.* The parts are to be then covered with adhesive plaster, and a bandage is to be applied, to retain them in their reduced apposition.

Sayre's dressing and the apparatuses of Drs. Fox, Levis, and Boyer, and the Velpeau bandage and that of Desault, are those most in vogue.

FRACTURES OF THE STERNUM.

This bone is rarely fractured; but a single case was admitted into the Hôtel Dieu in eleven years, and out of 1901 fractures received into the Middlesex Hospital, but two were fractures of the sternum.

The ordinary causes of fractures of the sternum are blows, kicks, and falls. A fracture of this bone is rendered evident by the inequalities perceptible when the surface is examined by the fingers. It is also characterized by a depression or elevation of the broken pieces, crepitus, and unusual mobility of the injured part in respiration. The breathing is difficult, and frequently accompanied with cough, spitting of blood, and inability to lie on the back. Discoloration and swelling soon follow the accident.

Treatment.—The application of compresses and an immovable bandage, to afford support to the chest and quietude to the intercostal muscles, are the indications.

In cases attended with great depression of the fractured bone, it may *become* necessary to elevate it.

FRACTURES OF THE RIBS

are generally caused by direct violence, and are usually situated in the anterior half; they may, however, be caused by indirect violence, as when the chest is forcibly compressed.

Symptoms.—Fixed lancinating pain, increased by inspiration, coughing, and other motion. Crepitation, which will be present, may be ascertained either by placing the hand over the seat of injury, and directing the patient to attempt a full inspiration or a prolonged expiration, or by auscultation.

When the lung is wounded, there will be emphysema over the exterior of the chest, which will be detected by the peculiar crackling which is heard when the skin is pressed upon. If the wound be deep, there will be hæmoptysis. In stout persons, or where the fracture is near the spine, it may be difficult of detection.

Treatment.—The indications are: 1st. *Diminish motion* of the ribs, and give support to the part, the respiration being performed by the diaphragm. The best is the adhesive plaster dressing, applied in strips from two to two and a half inches wide, extending over the affected side from the spine to the middle of the sternum; they should support the fracture and cover two or three ribs above or below the seat of injury. Or a broad flannel roller may be used, or the plaster splint.

The arms should be confined to the side, to prevent motion of the scapula.

2d. To *prevent inflammation* of the chest, keep respiration easy, and relieve pain by rest in bed, purgatives, and opiates if necessary.

FRACTURES OF THE SCAPULA.

The **Scapula** is so much covered with muscle, and its connections with the trunk allow so much yielding on the application of external force, that fractures of this bone are extremely uncommon. The injury may occur to its *body*, its *inferior angle*, its *neck*, to the *acromion* process, or the *coracoid* process. In fracture of the body of the bone the shoulder will be depressed and forced forward, and there will be marked irregularity between the ends of the fragments. Fracture of the *inferior angle* is marked by preternatural mobility, by displacement of the smaller fragment, and by acute pain at the seat of injury. In *fracture of the neck*, the acromion is unusually prominent, the head of the humerus is felt in the axilla, the shoulder is flattened, the limb is lengthened, the coracoid process is found below the clavicle, severe pain and numbness are experienced in the axilla, and distinct crepitation is perceived on rotating the arm upon the scapula. In fractures of the *acromion* and of the *coracoid,* the symptoms are somewhat similar to those presented by the fracture of the neck.

Treatment.—When the *body* is broken, a broad roller must be passed round the trunk, over a large, flat pad placed over the scapula, and a few turns made around the arm, so as to fix it to the side and prevent motion. Rest and quietude are required. Or a broad strip of adhesive plaster should be applied across the scapula, extending from the spine to the sternum, care being taken to press it well down along the anterior borders of the bone before the portions in front and behind the chest have been attached. Then place the arm in a Fox apparatus, and allow it to hang vertically along the side of the body, at the same time lifting the elbow by securing the straps to the ring on the opposite shoulder.

In *fracture of the neck* the shoulder must be supported by the sling and bandage that are used for fracture of the clavicle, but the pad should not be so thick, nor so large, and in addition a short sling should be used, going from the axillary pad on the injured side to the opposite shoulder. Opium, rest, leeches and purgatives may be necessary for the contusion with which this fracture is accompanied. At the end of four weeks passive motion must be made, to establish the functions of the joint.

In fracture of the *acromion* the bandages are to be so applied as to raise the elbow thoroughly, so that the head of the humerus may be lifted up against the acromion and keep its place. A pad must *not* be placed in the axilla, otherwise the broken part will be pushed too much outward.

When the *coracoid* process is fractured, the humerus must be brought forward and inward, so as to relax the coraco-brachialis, and must be confined to the trunk, with the forearm bent on the chest.

FRACTURES OF THE HUMERUS.

The **Humerus** may be fractured at any point. They are divided into (1) fractures of the upper extremity; (2) fractures of the shaft; (3) *fractures* of the lower extremity.

FRACTURE OF THE ANATOMICAL NECK.

Fracture through the anatomical neck is rare; it may be impacted or non-impacted.

In the *impacted* form the upper fragment is driven into the cancellous tissue of the lower portion.

Symptoms.—The axis of the humerus is altered, being directed toward the coracoid process; the elbow is slightly separated from the side; the arm is shortened; the shoulder flattened; the acromion is more prominent than usual; the head of the humerus can be felt in the glenoid cavity; there is no crepitus.

In the *non-impacted* form there is less deformity; there is a slight projection on the inner aspect; there is crepitus on rotation.

Treatment.—In the impacted fracture keep the part at rest by bandaging the arm to the side and supporting the elbow in a sling, these cases are often slightly deformed. In the non-impacted fracture it will be necessary to fix a small wedge-shaped pad in the axilla and adjust a felt cap to the shoulder, apply a spiral reverse bandage from the fingers to above the elbow. Place cotton between the arm and the chest and fix arm to chest by the second roller of Desault; carry forearm in sling, dress daily, keep skin active by liniments and commence passive motion at end of third week.

FRACTURE OF THE SURGICAL NECK.

Care must be taken not to confound this fracture with luxation of the bone downward and inward; in fracture of the neck the shoulder retains its natural form; the acromion does not project and the depression is below the point of the shoulder; in dislocation there is a deep depression below the projection of the acromion, in the natural situation of the head of the humerus. Always feel pulse to be sure the artery is not compressed or torn.

Symptoms.—The lower fragment forms a distinct prominence beneath the coracoid process, especially when the elbow is raised; the head of the bone can be felt in the glenoid cavity; there is a slight depression just below the end of the fragment; the axis of the limb is altered, being directed upward and inward toward the coracoid process; there is crepitus on extending and rotating the limb; the arm is shortened and unnaturally mobile; pain shooting down the arm is often present.

Treatment.—To support the weight of the limb, and keep it firmly fixed to the side, are the most effectual means of maintaining apposition; for this purpose, a thin pad, a compress, or a folded towel should be placed in the axilla, which must be held in its place by a bandage or by adhesive strips; the arm is then brought to the side, the elbow somewhat forward. The arm must then be securely fastened to the chest with circular turns of the roller, and the forearm placed in a sling. Another dressing very largely used in the Jefferson Hospital is the internal angular splint. Select a proper splint, pad it well, and fix in place by a spiral reverse bandage from the fingers to shoulder, where it is finished by a figure of eight turns. A shoulder cap should be put on either before or after the bandage and secured by a properly applied roller. The forearm is hung in a sling. The dressing should be worn for four weeks.

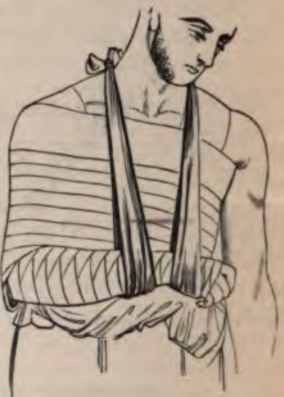


FIG. 72.—Fracture of the Neck of the Humerus.

FRACTURE OF THE SHAFT.

The existence of this fracture is easily ascertained; the head of the bone being grasped with one hand and the elbow with the other, upon rotating the arm no motion will be communicated from the lower to the upper portion, and crepitus will be distinguishable.

Treatment.—Reduce the fracture by extension, counter-extension and manipulation. Apply a well-padded internal angular splint and place the forearm in a sling. If this dressing does not retain the fragments there should be three short humeral splints adjusted instead of the shoulder cap. The dressing should be worn for five or six weeks and after its removal the forearm carried in a sling for four weeks.

FRACTURE IN OR NEAR THE ELBOW-JOINT.

When the condyles are obliquely broken off, just above the joint, the appearances are those of a dislocation of the radius and ulna backward; but in the case of fracture, the displacement recurs when the extension is remitted, and crepitus is generally perceptible when the forearm is rotated upon the humerus.

Treatment.—Anesthetize and thoroughly set the parts, examine if possible by means of the X-rays to see that they are in proper position. Prepare a well-padded anterior angular splint and secure in position by spiral reverse bandage; carry forearm in a sling. This method of treatment is useful in all cases excepting fracture of the inner condyle. In transverse fracture of the shaft of the humerus above the condyles it is the best dressing (DaCosta). Should posterior projection be present it may be necessary to use a moulded trough. The dressings are removed every third day, the parts kept in alignment and the arm gently massaged. Passive motion must be most guardedly attempted at the end of the third week and again at the end of the fourth week.

Another and most useful method of treating fractures about the elbow-joint is by means of Jones's position. Flex the forearm upon the arm and carry the hand to the opposite shoulder and secure it in position so that the ball of the thumb lies against the neck. The leather wristlet and glove devised by Prof. Charles Frazier is most admirable to maintain flexion. This dressing is not applicable for fractures of the olecranon which should be dressed upon straight splints. It is, however, particularly useful in children upon whom the anterior angular splint does not do well. After placing the limb in Jones's position always note the pulse lest compression may be present.

Fractures involving the elbow-joint are very liable to be followed by more or less deformity and the conservative surgeon will always protect himself by a careful statement of such facts to his patient and if possible have an understanding in writing to that effect.

FRACTURES OF THE FOREARM.

FRACTURE OF THE OLECRANON.

Symptoms.—There is loss of full power to extend the arm; the olecranon process will be above the line that connects the two condyles; the fragment is drawn upward by the triceps; a hollow is felt at the back of the joint. The upper fragment is not affected by flexion.

Treatment.—Extend the arm, and with the fingers bring the fragment down. Apply adhesive strips in the form of a figure 8 around the elbow, and a roller extending to the shoulder. Then apply an anterior splint of a slightly obtuse angle, padding it thickly opposite the joint; secure the splint by broad straps of adhesive plaster and a bandage. Retain the dressing for six weeks. Passive motion must be very slight, and not commenced until between the fourteenth and twenty-first day.

FRACTURE OF THE CORONOID PROCESS.

This fracture is very rare.

Symptoms.—Difficulty of bending elbow and dislocation of the ulna; the olecranon projecting backward.

Treatment.—The arm must be bandaged and kept at rest in the bent position. Union ligamentous.

FRACTURE OF THE SHAFTS OF THE RADIUS AND ULNA.

These bones may be both broken together, or they may be fractured singly. Easily recognized by the ordinary signs of fracture, especially crepitus, felt on fixing the upper end and rotating or moving the other. The X-rays are of the utmost importance in diagnosing all cases of fracture or disease of bones.

Treatment.—The indications are to prevent the fractured end of either bone from being pressed inward toward the interosseous space and to prevent the upper fragment of the radius from being more supinated than the lower.

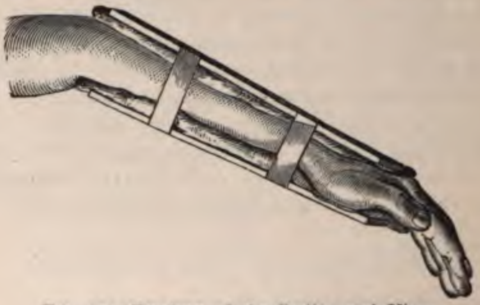


FIG. 73.—Fracture of the Radius and Ulna.

The elbow must be bent, and the forearm placed in a position intermediate between pronation and supination, the thumb pointing upward; one splint should be applied to the flexor side, from the inner condyle of the humerus to the tips of the fingers, and another from the outer condyle to the back of the wrist. Interosseous pads should be placed on both the flexor and extensor surfaces of the forearm. Both splints must be wide and well padded *along the middle*, so as to prevent the bones from being pressed together by the bandage. The splints are worn for four weeks and passive motion commenced during the third week.

FRACTURE OF THE NECK OF THE RADIUS.

This is exceedingly rare when uncomplicated with any other fracture. Mobility and crepitus will be perceptible, with flexion of the forearm, with loss of pronation and supination.

Treatment.—The forearm must be flexed upon the arm; a compress applied over the lower fragment, at the seat of injury: an *anterior angular* splint adjusted to the part, and over this a roller bandage. The arm must be kept in a sling.

FRACTURE OF THE LOWER EXTREMITY OF THE RADIUS.

This fracture is from one-fourth to one-half an inch above the wrist, and transverse in its direction; is generally known as Colles's fracture; when the fracture is oblique and begins within half an inch of and extends into the joint it is known as a Barton's fracture.

Treatment of Colles's Fracture.—Reduce the deformity by hyperextension, hyperlongitudinal traction and forced flexion. The above method of reduction was first outlined by Levis, and is to-day the best.

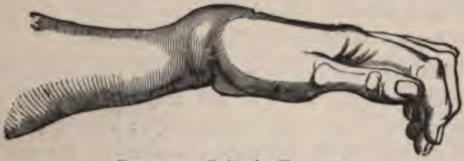


Fig. 74.—Colles's Fracture.

The surgeon must take the utmost care to insure the complete reduction of the lower fragment. Failure to properly reduce leads to weakness of the hand and ankylosis of the wrist. Levis's metal splint may be used. The bond splint is generally given the preference. The splint should be well padded and retained in position by a spiral reversed bandage; allowing the thumb and fingers to project. Before applying the bandage two pads, a dorsal and a flexor, are placed in position. The dorsal over the lower and the flexor over the lower end of the upper fragment. Passive motion is begun on the fingers in three or four days and upon the wrist during the second week. Remove the splint at the end of three weeks and apply a bandage to the arm. The straight dorsal splint suggested by Roberts is a very satisfactory dressing. Barton's fracture is dressed in a similar manner to Colles's.

FRACTURES OF THE CARPUS, ETC.

The bones of the carpus, when broken, are usually crushed by heavy bodies, or broken by direct violence; they are generally followed by severe and troublesome symptoms.

FRACTURES OF THE METACARPAL BONES,

or of the phalanges, are readily recognized.

For fractures of the carpus and middle metacarpal bones, it is a good plan to make the patient grasp some soft substance and bind his hand over it; for fractures of the lateral metacarpal bones, it is well to support the hand on a well-padded splint.

If necessary, apply cooling lotions.

FRACTURES OF THE PELVIS.

Fracture of the pelvis is usually the result of direct violence. A heavy fall, a cart-wheel passing over the pelvis, a squeeze between the buffers of two railway cars, and such similar accidents. It may, of course, result from gunshot wounds or from indirect violence, as when a person falls from a height and alights on his feet.

The symptoms are inability to walk, though the patient may be able to move his limbs in bed; mobility and crepitus, obtained by pressing on both crests of the ilium; pain on moving or coughing; displacement which may be recognized by external examination, per rectum, or per vagina.

Inability to empty the bladder or voiding of bloody urine denotes some injury of this organ.

Fracture of the acetabulum is indicated by the crepitus elicited on rotating the femur with one hand placed over the trochanter.

Separation of the symphyses, or of the *sacro-iliac synchondrosis*, is recognized by the free mobility of the part, and at the same time an interval may be felt in the situation of the separation. The pelvic viscera are frequently injured in this fracture; rupture of the bladder or urethra, giving rise to extravasation of urine, laceration of the rectum, or of the larger blood-vessels, may occur.

Usually the *rami* of the pubes and ischium are the seats of fracture; the line of fracture may pass above the acetabulum in various directions, or it may involve the acetabulum, fissuring its floor or fracturing its margin. The acetabulum may be comminuted, and the head of the femur driven into the pelvic cavity. Any portion of these bones may be broken, including the crest of the ilium or the tuberosity of the ischium, and not unfrequently both innominate bones.

Treatment.—Absolute rest of from six weeks to two months is essential. The pelvis must be bound around with *a broad roller* and the patient laid to rest on a *flat bed* or mattress. The thighs must be flexed upon the abdomen and supplied with pillows under the knees.

Fracture of the *acetabulum* must be treated by means of a long splint, or hip splint of gutta-percha, moulded to the side of the pelvis and thigh, so as to fix the joint. A catheter, to ascertain the state of the bladder, should be introduced. If bloody urine, or other symptom of injury to this organ or to the urethra be present, the catheter must be kept in the bladder, to prevent extravasation.

If rupture of the bladder has occurred in the part uncovered by peritoneum, as the anterior wall or base of the organ, the urine will find its way into the connective tissue between the peritoneum and abdominal wall, producing sloughing; it may burst into the peritoneum and reach the subcutaneous connective tissue, or pass through the pelvic foramen into the scrotum and thighs. An open wound of the bladder is not as dangerous as a laceration.

The symptoms of rupture of the bladder are collapse, violent burning pain in the hypogastric region; a constant and incessant desire to urinate, with inability to pass any water. A small quantity of blood may flow from the urethra. The patient is unable to stand or walk. On passing the catheter the bladder will be found empty. Urgent tenesmus and peritonitis soon set in. If the rupture is extra-peritoneal the symptoms are those of extravasation of urine. There will be a characteristically *bounded swelling,* with increasing size and extent; the scrotum and penis becoming enormously distended; a sensation of *sudden relief* of the distended bladder is immediately followed by an *acute burning* sensation in the peritoneum. *Gangrenous inflammation* of the cellular tissue soon supervenes, the skin assumes a dusky red hue, purplish or black gangrenous spots appear. Ultimately sloughing of the skin and cellular texture of the scrotum exposes the testicles.

The urethra may burst in *front* of the *bulb,* when the urine infiltrates into the *corpus spongiosum,* which is followed by gangrene. The *constitutional* disturbance is that of low typhoid depression; a rapid, feeble pulse, dry, brown or black tongue, and muttering delirium as death approaches.

Treatment.—When the laceration is *intra-peritoneal* laparotomy should be performed, the peritoneal cavity carefully cleaned of blood and urine; the rectum must then be distended with a rectal bag, and the rupture carefully stitched with silk sutures. Cystotomy is then performed, to secure an exit for the urine. If *extra-peritoneal,* and extravasation can be made out by external examination, free incisions, both supra-pubic and perineal, must be made, followed by median cystotomy. The constitutional treatment should be supporting and opiates should be freely administered.

FRACTURES OF THE THIGH.

1. FRACTURE OF THE NECK OF THE FEMUR WITHIN THE CAPSULE.

It is rare in persons under fifty, and generally occurs in old persons, especially women.

Symptoms.—After a fall or blow, the patient is unable to stand; there is great pain, principally at upper and inner part of the thigh, increased by motion. The leg is shorter, the foot turned outward, rarely inward; the heel rests in the interval between the ankle and tendo-Achillis; when the limb is drawn to proper length and rotated, crepitus may be detected. When extension is discontinued, the limb again shortens. The limb may be freely moved by the surgeon, but the patient cannot move it from the bed.

Dr. Allis was the first to point out the fact that in all fractures situated above the insertion of the tensor vagina femoris, but especially in those occurring within the capsular ligament, the fascia lata is relaxed to such an extent as to make its want of tension of strong diagnostic value.

If the fibrous investment of the neck be not torn, or if the fracture be very oblique, so that the upper opposes the ascent of the lower fragment, there will be little or no shortening.

This fracture does not unite by bone, unless the broken surfaces are held close together by the untorn periosteum or by impaction. Generally it does not unite at all.

Treatment.—If the patient is old and feeble, he should be kept in bed for a fortnight, till pain and tenderness abate, with a heavy sand-bag on each side of the limb, and a bag of shot or sand attached to the foot or ankle, which should be allowed to hang over the bed. He then may be allowed to sit in a rolling chair, and shortly begin the use of crutches.

Professor Senn claims that by his method of "immediate reduction and permanent fixation," bony union is obtained in fractures of the neck of the femur within the capsule. He "places the patient in the erect position, causing him to stand with his sound leg upon a stool or box about two feet in height; in this position he is supported by a person on each side until the dressing has been applied and the plaster is set.

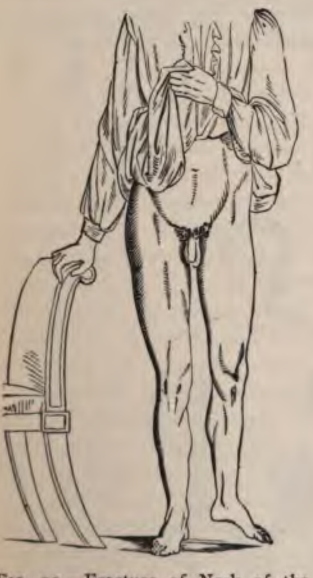


FIG. 75.—Fracture of Neck of the Femur.

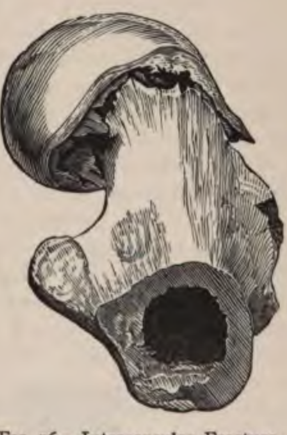


FIG. 76.—Intracapsular Fracture.

"Another person takes care of the fractured limb, which is gently supported and immovably held, in impacted fractures, until permanent fixation has been secured by the dressing. In non-impacted fractures the weight of the fractured limb makes auto-extension, which is often quite sufficient to restore the normal length of the limb; if this is not the case, the person who has charge of the limb makes traction until all shortening has been overcome as far as possible, a

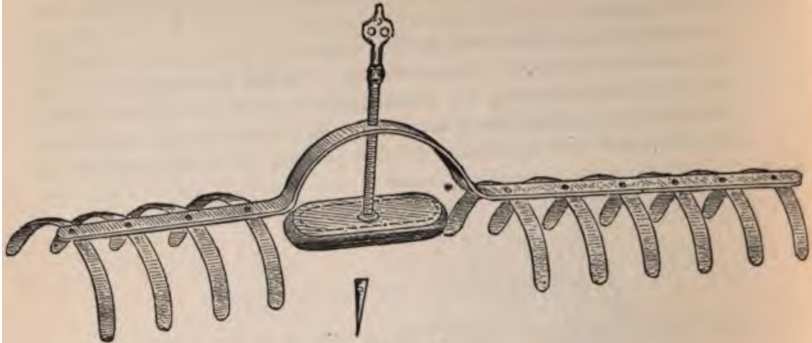


FIG. 77.

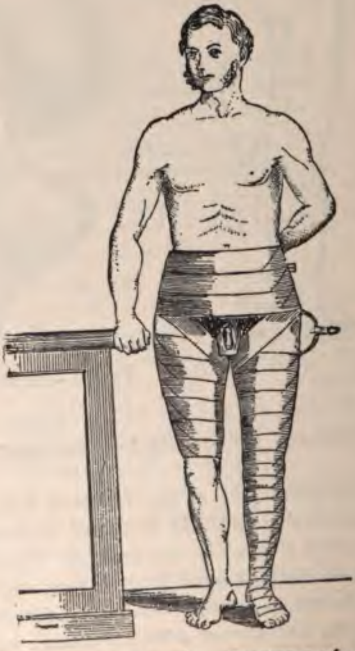


FIG. 78.—Senn's Apparatus for Treating Fracture of the Neck of the Femur.

the same time holding the limb in position, so that the great toe is on a straight line with the inner margin of the patella and the anterior superior spinous process of the ilium. In applying the plaster-of-Paris bandage over the seat of fracture a fenestrum corresponding in size to the dimensions of the compress with which the lateral pressure is to be made is left open over the great trochanter.

"To secure perfect immobility at the seat of fractures, it is not only necessary to include in the dressing the fractured limb and the entire pelvis, but it is absolutely necessary to include the opposite limb as far as the knee, and to extend the dressing as far as the cartilage of the eighth rib. The splint, which is represented by Figure 68, is incorporated in the plaster-of-Paris dressing, and must be carefully applied, so that the compress, composed of a well-cushioned pad with a stiff, unyielding back, rests directly upon the trochanter major, and the pressure, which is made by a set-screw, is directed in the axis of the femoral neck. Lateral pressure is not applied until the plaster has completely set. Syncope should be guarded against by the administration of stimulants. As soon as the plaster has sufficiently hardened to retain the limb in proper position, the patient should be laid upon a smooth, even mattress, without pillows under the head, and in non-impacted fractures the foot is held in a straight position, and extension is kept up until lateral pressure can be applied.

"No matter how snugly a plaster-of-Paris dressing is applied, as the result of shrinkage it becomes loose, and without some means of making lateral pressure it would become necessary to change it from time to time, in order to render it efficient. But by incorporating a splint, as shown in Figure 68, in the plaster dressing (Figure 69) this is obviated, and the lateral pressure is regulated, day by day, by moving the screw, the proximal end of which rests on an oval depression in the center of the pad."

FRACTURE EXTERNAL TO THE CAPSULAR LIGAMENT.

It is caused by direct violence, and in consequence of other injuries around the great trochanter, or of the cervix being firmly impacted; the diagnosis is very difficult; there is no crepitus; the limb is shortened, but cannot be brought to its natural length by any justifiable amount of tension.

Treatment.—It is treated by extension and counter-extension, just as in fracture of the shaft of the bone.

FRACTURE JUST BELOW THE TROCHANTERS.

The upper fragment is tilted forward by the psoas magnus and iliacus.

Treatment.—Extension is made by the action of a weight and pulley, and counter-extension by elevation of the foot of the bed. The limb is kept at rest between two sand-bags, and the dressing is completed by fastening a broad binder around the pelvis.

FRACTURE OF THE SHAFT OF THE FEMUR.

The symptoms are plain and unmistakable; there is pain, swelling, crepitus, preternatural mobility, and deformity.

Treatment of Fractures of the Upper Third.—The lower fragment must be brought to the upper; the thigh must be flexed. Professor Nathan R. Smith's splint is generally recommended. It is an anterior wire splint from which the leg is suspended. First make a double inclined plane with pillows so adjusted that the fragments will fall into place; lay five or six strips across the pillow to fasten around the splint after complete coaptation of the parts has been made. The splint is bent at the knee and turned up at each extremity to accommodate the flexions of the ankle and groin. Apply a roller around the limb and splint to support the strips and a few spicas to fix the splint at the groin. Suspend the limb and then remove the pillows. Professor Agnew's apparatus for fracture of the upper third of the femur "consists of a double inclined plane with hinged sides attached to the thigh-piece; upon this the limb is deposited, a pillow being interposed between the thigh and the splint and a soft pad placed beneath the leg; an adhesive strip is next attached to the sides of the thigh, extending up as far as the upper end of the lower fragment, and with a loop below, into which is to be fastened a piece of light wood, as in the ordinary fracture dressing. To this piece of wood a cord is attached, which is to be carried over a pulley set in an upright board that is to be screwed to the foot of the bed. To this cord the extending weights are attached. Lateral pressure is applied to the thigh by bringing up the sides of the femoral part of the plane and securing them by strips of muslin while the leg is retained in position by turns of the roller."*

Treatment of Fracture of the Shaft Below the Upper Third.—The method is now generally pursued of extension by the action of a weight and pulley, and counter-extension is made by elevation of the foot of the bed.

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* "Agnew's Surgery," Vol. 1, p. 957.

A strip of adhesive plaster from two and a half to three inches in width is stretched along on each side of the limb to a short distance below the seat of fracture, and confined with a roller extended from the toes up to the groin, the middle of the plaster forming a loop below the sole of the foot. A thin block of wood, the width of the plaster and long enough to prevent pressure over the ankle, is inserted into the loop, and serves to receive the extending cord, which is fastened to an elastic rubber band passing around the block and playing over the footboard, or over a temporary frame, perforated at a height of about four inches above the level of the mattress, or an adjustable clamp may be used, holding in position the rod which supports the pulley. (Fig. 70.) The thigh, at the seat of the fracture, is surrounded with short splints, and a bandage is applied from the toes to the groin; the heel is supported upon a thin, wedge-shaped hair cushion; a bag filled with sand is placed along the outer and another on the inner aspect of the thigh and leg to prevent motion. The amount of weight employed must be determined by the age of the patient and other circumstances of the case. An adult will require from ten to twelve pounds; a child under eight years of age will require about six pounds.

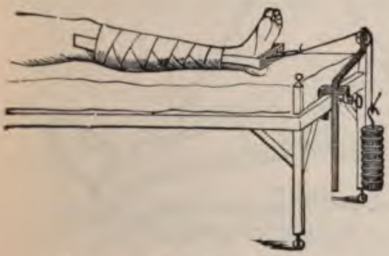

FIG. 79.—Extension Apparatus.

Liston's long splint; that of Desault, modified and improved by Physic; N. R. Smith's anterior splint, which is especially adapted to cases where the upper third of the bone tends to tilt forward; Hodgen's suspension apparatus; Levis's extending apparatus; Dr. Buck's apparatus; and that of Morton, which is in use in the Pennsylvania Hospital, are all in vogue with the profession, and each has its advocates.

FRACTURE OF THE FEMUR IN CHILDREN.

These fractures heal readily and are rarely followed by an appreciable shortening.

Treatment.—When the limb has been adjusted and drawn to its proper length a plain roller is to be applied, beginning at the foot, and ending at the groin with a spica; a sufficient quantity of cotton wadding to prevent irritation having been placed at the ankle, the knee, and the crest of the ilium, a long splint is laid along the outer side of the body, extending from the axilla to three or four inches below the foot, and is to be bound in this position by plaster rollers, likewise commencing at the foot and ending with a spica at the groin.

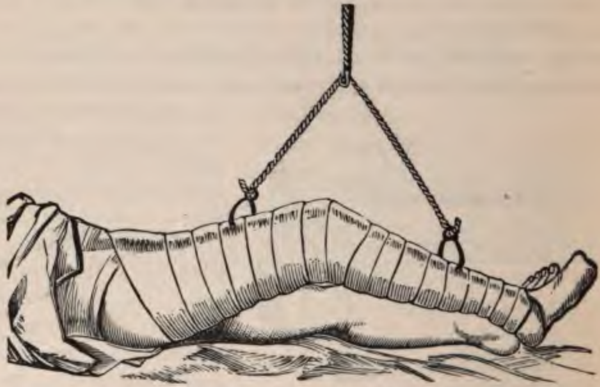

FIG. 80.—N. R. Smith's Anterior Splint.

The upper part of the splint is to be secured to the trunk by a roller. Silicate of soda or starch may be used instead of plaster; when the former is employed, three or four strips of pasteboard should be laid around the seat of fracture, secured by a roller, to which the silicate of soda is to be likewise applied.

FRACTURES OF THE PATELLA.

The patella may be fractured longitudinally, but is usually broken transversely.

In longitudinal fracture, the treatment is to reduce the inflammation by evaporating lotions, and then apply a roller, and afterward a laced cap, with a strap to buckle above and below the knee; the union, as a rule, will be ligamentous.

Transverse Fracture.—The upper fragment is drawn upward by the action of the muscles inserted into it while the lower part remains stationary. The injury is known by the depression between the two portions of bone; the power of extending the limb is lost and the knee bends forward. The union of the fracture is generally by ligament.

The treatment indicated is to keep the leg steadily extended, the thigh at the same time flexed upon the pelvis, and the body kept in the semi-erect posture; a strong and well-padded tin or wire case may be used, reaching from the middle of the thigh to the corresponding point of the leg. Professor Brinton prefers to use a posterior splint, reaching from the heel to the gluteal fold, a roller having been previously applied from the toes upward, and another from the groin downward. The fragments, having been brought in apposition, are confined by numerous adhesive strips, carried around the bone above and below the joint, and afterward connected by vertical and transverse pieces. The splint should be kept applied for six or eight weeks; at the end of this period it may be left off, and the patient be allowed to get about on crutches, wearing a stiff bandage to prevent any flexion of the joint. Manning's splint, the splint of Agnew and of Hamilton, Malgaigne's hooks, Levis's hooks, and the hooks of Morton, each have their advocates.

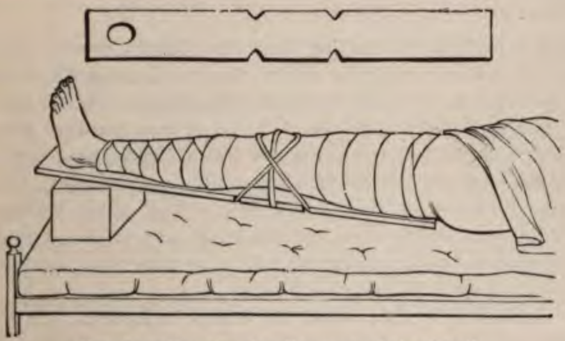

FIG. 81.—Dressing for Fracture of the Patella.

Laying open the joints and wiring the fragments is recommended by Sir Joseph Lister, and has been resorted to in a large number of cases with comparative success.

To perform this operation, a longitudinal incision is made over the center of the joint, which is opened, and the fragments of the patella are exposed; any blood clot which is present in the joint, or between the fragments, is turned out, and the fragments themselves are cleared of any aponeurotic and fibrous tissue which may be found lying between and over their broken surfaces. Each fragment is then bored obliquely with a drill, taking care not to reach its cartilaginous surface. Sutures of silver wire or of heavy catgut are then passed through the drilled holes, and the fragments having been drawn together, the ends of the wire are twisted, cut short, and then hammered down on the bone, where they may be allowed to remain permanently, without causing any irritation. This operation, if performed, must always be carried on under the most careful aseptic precautions; free drainage must be provided for by the insertion of tubes in openings made at the back of the joint on either side.

It is proper to observe that wiring the fragments has, in several cases, been followed by suppuration in the joint, and as a consequence the limb, and even the patient's life, has been lost.

Kocher's method of treating fractured patella consists in passing a stout silver wire completely around the bone. A needle in a handle is passed through the ligamentum patellæ, through the tendon of the quadriceps, and out through the skin. It is then threaded and drawn back again; the broken fragments are drawn together, the wire twisted up over something, to protect the skin, and the openings dusted over with iodoform. The limb is then placed upon a back splint, bandaged, and kept in this position for three weeks; at the end of this time the wire is cut, drawn out of the wound, and the sore points that are left dusted with iodoform until the parts are healed.

For the first few days after the injury is incurred, antiphlogistic measures are to be employed, before any permanent treatment is to be resorted to.

FRACTURES OF THE LEG.

The two bones may be broken together, or they may be broken separately. The commonest fracture of the tibia is in the lower third; it is most frequently oblique, with the upper end directed downward and forward, so that it rides over the lower fragment; the fibula may give way at the same time, at a point nearly opposite. The tibia may also be broken transversely, at either the upper or lower half.

The fibula is less frequently broken than the tibia. Both bones are seldom broken at the same level, unless by direct violence. The tibia is weakest at its lower extremity and the fibula at the upper part.

Fracture of the lower end of the fibula, accompanied by dislocation outward of the foot, at the ankle joint, is known as **Pott's fracture.**

The bone is broken from two to four inches above its lower extremity, the ends of the fragment being driven inward. The signs of this injury are a well marked depression at the seat of the fracture; the foot is twisted outward and the sole everted by the peronei; the inner malleolus is unbroken, projects prominently beneath the skin. If separated, the detached fragment can be readily felt. Crepitus may be readily obtained. The heel is drawn upward.

There are many methods of treatment: By the common splints: first reduce the fracture; apply the many-tailed bandage, and then use the shaped splints of Cline, supported by sand-bags, or apply Macintyre's splint or Boyer's board and pillow dressing. The fracture box; the stiffened bandage, using the silicate of potash, paper and paste; plaster-of-Paris; or chalk and gum bandage, are in general use and commended in turn.

In Pott's fracture *Dupuytren's splint* is generally recommended; it is a straight wooden splint, notched at its lower end, and reaching from the head of the tibia to about four inches below the sole of the foot. It is applied to the inner aspect of the leg; a thick pad, extending to the inner malleolus, must be interposed between the splint and the leg. The upper end of the splint is to be bandaged to the limb. The foot is drawn across the lower part of the splint, the thick pad acting as a fulcrum, and the foot is fastened to the splint by a figure-of-8 bandage, carried around the ankle and foot and through the notches at its lower end.

Boyer's dressing consists of two splints, a pillow, a splint cloth, and three strips. The splints should extend from above the knee to below the foot; they must be wrapped in the splint cloth, a bandage applied around the foot to keep it everted and set in the natural position; the finger should be run along the spine of the tibia, to see if the fragments are in position, when the splints should be applied and kept in place by the strips, the fractured limb resting on the pillow between the splints.

The fracture box consists of two sides attached to a base, with a fenestrated foot-board. A pillow is to be placed in the box and the foot is to be affixed to the foot-board. The heel must be protected by a ring of oakum, and is not to touch the foot-board. The fragments are then to be adjusted and the sides of the board brought up and tied together with strips. The box should always be swung.

FRACTURES OF THE FOOT.

These fractures are of rare occurrence, and result from severe crushes, and usually several bones are involved in the injury. The fracture is generally compound.

The *os calcis* is sometimes fractured as the result of a fall upon the heel.

If the bone be fractured in front of the ligaments there is but slight displacement; there will be crepitus on making lateral movements and grasping the heel; there will also be flattening, pain, and swelling.

Should the posterior part be separated behind the attachment of the interosseous ligament, the fragment is drawn up by the muscles of the calf and projected posteriorly. Crepitus can be obtained by bringing the fractured extremities in apposition.

Fractures of the *metatarsal* bones and *phalanges* are always the result of direct violence.

Treatment.—When the posterior portion of the os calcis is separated and drawn away by the muscles of the calf, the latter should be relaxed and the fragments brought into apposition by placing the limb on an outside splint, with the knee flexed and the foot extended. The apparatus used for rupture of the *tendo-Achillis* will often answer the indications. In fracture of any of the other bones of the foot, it should be kept at rest, either on a splint with a foot-piece, or by means of some form of stiff bandage. In all forms of fractures of the tarsal bones timely motion should be employed to prevent ankylosis.

TREATMENT OF COMPOUND FRACTURES.

If the limb is put in a stiff bandage, an opening must be cut over the seat of fracture, in order to allow of the wound being examined and dressed when necessary.

If there is a mere puncture of the skin, caused by one of the sharp ends of the fragments, it should be treated antiseptically and closed at once, by applying a pad of cotton dipped in iodoform and collodion. If under this treatment the temperature rises and the parts become hot, red, painful, and swollen, the pad should be removed, and if there be evidence of suppuration, the wound must be opened, the parts carefully cleansed, and thoroughly syringed out with normal salt solution.

If the wound is of a larger size, its edges lacerated, tissues bruised and swollen, it should not be closed at once. A tourniquet should be applied, and sterile towels placed under the part, which should then be shaved. Any remaining soap must be washed away with alcohol and the parts washed with a 1:1000 solution of corrosive sublimate.

Be sure to place sterile towels wherever instruments may possibly be laid, or wherever the operation may extend.

Freely enlarge the wound, if necessary, and constantly irrigate with normal salt solution.

Trim away all muscular and other soft tissues which are injured to such an extent that they cannot live; remove loose fragments and rough margins of bones, and shape the ends so that they will fit each other; then drill holes into them so that they can be fastened together with silver wire.

The muscular tissue is to be united or approximated by chromicized catgut sutures.

The ends of large nerves that are divided must be carefully trimmed, and brought together with fine catgut sutures.

Bleeding vessels are to be tied with catgut ligatures.

When hemorrhage is controlled, put in the wound a drainage tube of large calibre, making a free counter-opening if necessary.

Finally wash out the parts with normal salt solution, and bring together the margins of the wound with silkworm-gut sutures.

Powder sterilized iodoform over the wound and dress with a sufficient quantity of sterile gauze. Then apply an ordinary roller bandage, and finish the dressing with a plaster-of-Paris splint. Sling the limb to a bar above the bed.

Change the dressings in a week, so that the drainage tube may be removed, and put in its place an iodoform drain, using at the same time bichloride irrigation.

Sprinkle iodoform about the wound, and dress as heretofore directed.

Hot and cold douche, massage, and passive motion will be required after removing the final dressings.

Amputation may be necessary where there is extensive destruction and laceration of the soft parts, with much splintering of the bone, especially if the main vessels of the limb are wounded, or an adjacent joint laid open.

During the treatment, many complications may arise, such as *edema* and *swelling* of the limb, *ulceration* and *sloughing, spasms* of the muscles, *gangrene*, and venous thrombosis.

When edema presents itself, the bandages should be slackened, and an evaporating lotion applied; if the tissues are bruised, paint the parts with tinct. benz. comp.; should bullæ form, they may be pricked, and their contents allowed to escape.

Ulcers are apt to form over bony prominences, and *bedsores* may appear over the sacrum, buttocks, hips, etc. These must be treated antiseptically.

Gangrene, as a rule, is the result of tight bandaging or other improper treatment. The part should be frequently examined, and if there be coldness, numbness, lividity or swelling of the limb, the bandages should be at once relaxed.

SPRAINS.

A Sprain is a violent stretching of the ligaments, tendons, or fascia surrounding a joint, with or without rupture of some of their fibers and blood-vessels.

It usually happens from the sudden extension of the joint in the direction for which the muscles are unprepared; the most common situations of these accidents are the wrist or ankle.

The pain produced is instant and severe, frequently attended with faintness; the parts begin to swell immediately, and there is great tumefaction and ecchymosis, and subsequently weakness and stiffness of the part. There is inability to bear any weight on the limb, and any attempt to move the joint surfaces on each other is attended with increased pain.

The remote effects of this lesion are often permanent pain and weakness; or stiffness and even ankylosis.

Treatment.—The patient should at once go to bed, so as to ensure perfect rest; the part affected should be confined to a splint behind, held in place by a comfortably applied bandage, and the position of the limb should always be such as to relax the muscles. Immerse the limb in water of a temperature as hot as the patient can bear, and let it remain there for at least half an hour; acetate of lead and opium should then be applied through the medium of wet rags. If the strain be complicated with laceration of ligaments, apply a splint of silicate of soda or plaster-of-Paris as soon as the inflammation has subsided.

Should the pain and tumefaction increase, and if the patient is very plethoric, and the injury extensive, purgatives and general bleeding must be had recourse to.

Care should be taken not to use the part too early.

Should the disease become chronic, friction with moderate pressure should be used; stimulating liniments should be rubbed over the parts, which should be kept neatly bandaged; blisters should be resorted to, and good effects are often produced by pouring a continued stream of cold water over the part.

SYNOVITIS.

Synovitis, or acute inflammation of the synovial membrane, alone may be produced by local or constitutional causes, such as blows, strains, mechanical injuries, penetrating wounds, exposure to cold, syphilitic or gonorrhœal infections, and gout. There are two forms, the acute and the chronic.

The knee-joint is the most frequently affected.

Symptoms.—Severe aching pain in the joint, increased by motion, pressure and a dependent position. The pain is usually worse at night. There is also swelling, redness of the surface, tenderness and fever, which is frequently violent.

The swelling, which is occasioned by a rapid effusion of fluid into the synovial cavity, is distinctive. There is evident fluctuation, if the joint is superficial. The shape of the joint is always altered.

When the knee is affected the patella is pushed forward, and there is great fullness on each side of it, and at the lower and front part of the thigh. The swelling, if at the elbow, is most distinct above and between the olecranon and the condyle; and in the hip there is general fullness of the surrounding parts, and tenderness on pressure.

Treatment.—Limb must be kept absolutely motionless. A splint must be applied, after being padded, so that it may be fastened some distance above and below the joint, and care must be taken that it does not touch the affected part. Leeches to the joint, cups in the neighborhood, evaporating lotions or hot fomentations. Calomel purgatives should be administered; and opiates, to relieve pain. When there is a tendency to the disease becoming chronic iodide of potassium should be administered. And if the disease be connected with rheumatism, ammonia and potash should be prescribed. Where there is a tendency to gout, colchicum with potash is to be employed. In syphilitic cases, mercury, in its different forms, is most to be relied upon. Aspiration of the joint may be done under the most rigid asepsis. Should the joint refix the rubber bandage may be applied. In chronic cases blisters may be applied. In synovitis of gonorrhœal origin the use of stimulating ointment containing ichthyol is often beneficial. In chronic synovitis massage, electricity, dry heat, stimulating ointments containing 50 per cent. ichthyol and change of climate may do much toward a cure. Should there be danger of ankylosis always put limb in that position where it will be most useful.

COXITIS, OR TUBERCULOUS DISEASE OF THE HIP JOINT.

This disease is most frequent from the third to the seventh year.

The first circumstance that indicates disease of this joint is some degree of lameness and pain in the knee, with more or less weariness, some eversion of the foot and dragging of the leg. The motions of the joints is impeded; extension is performed with difficulty; the knee is bent; the heel on the diseased side scarcely rests on the ground; there is great difficulty experienced in the flexion of the joint.

To ascertain whether disease exists, the patient is placed on his back and examined, to ascertain whether the sides of the pelvis are equal; the pelvis will be lower on the diseased side. Then bend the knee on the abdomen; if there be disease of the hip joint, considerable pain will be occasioned. In rotating the joint pain will be excited. If the patient is turned on his face the nates on the affected side will be found lower.

If the surgeon presses on the hip joint, either in front, over the psoas and iliacus, or behind the great trochanter, or jerks the femur against the acetabulum by a sharp tap on the trochanter, major or heel, pain will be felt in the hip, and that in the knee will be greatly aggravated.

Abscesses are frequently formed in this disease, that take various directions; as a rule, their course is down the thigh, where they break; they may, however, occur in the upper part of the thigh, the rectum or vagina.

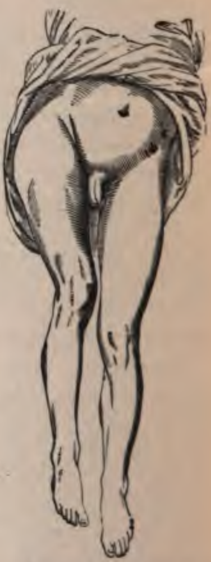

FIG. 82.—Coxalgia.

The pain of complete extension of the joint, and the instinctive resistance of the patient to this position, when laid on a flat, hard bed, producing, when the knee is pressed straight, a sudden arching of the lumbar curve, is very characteristic of the disease, even in the earliest stages.

Treatment.—The patient must be kept at perfect rest in the straight posture, by means of sand-bags placed on each side of the limb; that on the outside reaching as far as the axilla.

If an abscess form, open the part at once and drain it thoroughly. Excision of the head of the femur may become necessary. Before doing an excision DaCosta recommends intra-articular injections of 10 per cent. iodoform and glycerine under thorough aseptic precautions. The plaster-of-Paris dressing is useful when applied from the tip of the toes to and including the pelvis.

Extension and counter-extension must be strictly kept up, in the same manner as in treatment of fractures of the lower extremities.

Dr. Buck's American stirrup may be used with advantage.

When the patient is in a condition to take exercise in the open air, the apparatus of Dr. Sayre answers all the indications. The use of creosote and a change of climate with forced feeding may attain a happy result.

ANKYLOSIS.

Ankylosis is an osseous or ligamentous union of the joint ends of bones, impeding or preventing motion; it frequently follows injuries or disease of the joints.

False ankylosis depends on the thickening of the synovial membrane, or organization of bands of adhesion within and around the joint.

Ligamentous ankylosis is the union of two articular surfaces by fibrous tissue.

Bony ankylosis results where the fibrous tissue becomes ossified.

Treatment should not be attempted until the diseased action has ceased and parts return to a quiescent condition. After this, *passive motion*, combined with friction, may be resorted to. A screw fitted to a splint with a hinge in it may be used to gradually straighten the joint.

Forcible or immediate extension, by breaking up ligamentous adhesions, is frequently employed; and any tendons, fascia or muscular fibres whose rigidity is an obstacle, may be divided by subcutaneous section.

When the knee is affected, the hamstring muscles and portions of the fascia may be divided; if the elbow, the biceps may be cut. The joint should then be extended by main force.

When the ankylosis is bony and the *limb fixed in position*, a resection may be performed. If the position of the limb be a useful one it may be allowed to remain. Never attempt to break up an osseous ankylosis. Osteotomy is sometimes done to secure better position.

CARIES.

Caries is a disease of the bones supposed to be analogous to ulceration of the soft parts. There are two principal forms: caries necrotica and caries sicca. Tuberculosis produces a characteristic form spoken of as tuberculous caries.

Bones of a spongy texture are more frequently attacked by caries than such as are compact; hence the vertebræ, astragalus and other bones of the tarsus, those of the carpus, the sternum, the pelvis, and the heads of the long bones, are often affected; the bones of young persons are more frequently the seat of caries than those of old subjects.

On examination, the bone is found to be soft and dark red; its cells are filled with a reddish, serous, glairy fluid, or with soft granulations of feeble vitality. After a time suppuration occurs between it and the surface, the abscess breaks, and the carious portion of the bone, already softened, gradually perishes in minute particles, which are thrown off and discharged with the pus. The bone appears enlarged, and one or more sinuses open, at points that are soft and sunken.

The predisposing cause is some constitutional disorder, scrofula, or syphilis. The exciting cause may be a blow or injury. Typhoid fever is often followed by caries.

Treatment.—Rectify constitutional disorder and remove local disease. Change of air, tonics, sea air, sea bathing, and the usual remedies employed in scrofula and syphilis are indicated. If the patient be tubercular change of climate and forced feeding are indicated.

Locally, the best treatment is to freely expose and remove the diseased portion of bone. Diseased bone is usually white, soft and does not bleed.

NECROSIS.

Necrosis is the death or mortification of a bone, and is applied to cases in which part of the shaft of a bone dies, from injury or violent inflammation. The term exfoliation signifies necrosis of a thin, superficial layer, which is not encased in new bone.

This disease most frequently attacks bones of compact tissue; the shafts of the femur and tibia are often the seat of this affection. Necrosis of the lower jaw frequently results from the inhalation of the fumes of phosphorus by persons employed in lucifer match factories; this causes inflammation and thickening of the periosteum, followed by abscess, resulting in necrosis of a portion of the (phosphor necrosis) bone.

The bone, in necrosis, dies, from obstruction of its circulation; but the periosteum, with the articular extremities, its medullary membrane, and other contiguous parts, speedily ossify and form a new shell around the dead portion, and adhere to the living bone above and below.

Symptoms.—After acute inflammation, the bone remains permanently swelled, and the apertures made for the discharge of matter remain as sinuses (cloacæ); these sinuous apertures in the skin usually correspond to holes in the shell of the new bone, and by passing a probe through them, the sequestrum may be felt, loose, in the interior.

Treatment.—The indication is to remove the sequestrum, as soon as it is sufficiently loose. If small, it may be grasped and removed with a forceps; if larger, a free incision should be made, so as to expose the surface of the bone, and it should be made at a point where the *cloacæ* exist, or where the bone is nearest the skin. The new shell must be perforated with either a Hey's saw, or with a chisel or gouge, and the sequestrum drawn out. The wound may be filled with decalcified bone chips, as recommended by Senn.

RICKETS, OR RACHITIS.

This is a peculiar disease, produced by a morbid condition of the whole body, and generally arising from hereditary taint, defective hygienic conditions, want of fresh air and light. It is frequently attended with scrofulous disease. Its leading characteristic is imperfect development, atrophy and distortion of some of the bones of the body; these are soft, and consist of a sort of semicartilaginous tissue, which will bend without breaking. The articular portions are often disproportionately large. The shafts are unable to support the weight of the body without bending.

The physiognomy and general appearance are very peculiar; the stature is stunted, the head large, and the forehead protuberant. The face is small and triangular, chin sharp, teeth projecting, chest prominent and narrow, the spine variously curved; the pelvis small; the promontory of the sacrum and acetabulum pressed together; the limbs crooked, their natural curves increased.

Treatment.—Invigorate the constitution, if possible.

Codliver oil, iron, compound syrup of the hypophosphite of lime, soda, potash and iron, and such other remedies as are usually prescribed for scrofula.

Diet should be generous and nutritious; animal food, milk, eggs, etc., etc. Sunlight and pure air.

If possible, use some mechanical contrivance to straighten the bones, and keep them in that condition until they are strong enough to bear the weight of the body.

If necessary, perform some one of the numerous operations recommended by surgical authorities to suit the cases as they present themselves.

DISEASES OF THE SPINE.

PSOAS AND LUMBAR ABSCESS.

These are chronic collections of tubercular fluid, which form in the cellular substance of the loins, behind the peritoneum, and descend in the course of the psoas muscle; if the disease form on the side of the vertebræ, instead of the fore part, it is termed lumbar abscess.

At the beginning there is little or no pain, no inflammation, nor is there febrile disturbance; but previous to the appearance of any other symptom the patient has an unaccountable feeling of weakness across the loins, accompanied by pains, usually giving no indication of the seat of the disease, and likely to be regarded as rheumatic.

The tubercular material is formed slowly and imperceptibly, and occasions, at first, no manifest swelling nor fluctuation.

When the lower dorsal or upper lumbar vertebræ are diseased, the pus enters the sheath of the psoas, or the substance of the muscle, and is firmly bound down in front by the fascia covering this muscle and the iliacus.

The abscess proceeds as far as the tendon of the muscle by Poupart's ligament, when its further progress is apt to be arrested. When it has attained considerable magnitude it passes under Poupart's ligament, between the femoral vein and the symphysis pubis.

The diagnosis is difficult when the abscess is unattended by an external tumor.

The swelling takes place in various situations and assumes different aspects; it may appear beneath the femoral fascia, or it may descend as far as the knee and form a prominent swelling; sometimes it will make its way downward into the pelvis and occasion a swelling in the neighborhood of the anus, or it may appear in the vicinity of the vertebræ, or, again, it may make its way through the abdominal muscles.

This disease arises generally from cold, strains, or falls, and from general debility, and not unfrequently from spinal affections.

Treatment.—A psoas abscess should be opened, if possible, before it leaves the abdomen, just above Poupart's ligament, external to the line of the vessels. If it points at the inner side of the thigh, an incision may be made also in thát situation, in addition to the one above Poupart's ligament. Under antiseptic precautions, the sooner the abscess is opened the better, for the abscess cavity is then smaller than if the surgeon waits till the fluid has burrowed its way into the thigh. Free drainage should be established from the groin to the lumbar region. The operation of Treves and a complete eradication of the entire sac are by far the best and most radical procedure to pursue when the patient's health will permit. For a description of these the student should consult the textbooks.

The same principle of treatment must be applied to lumbar abscesses. Antiseptic dressings must be continued as long as there is any discharge.

The general treatment must be tonic and alterative.

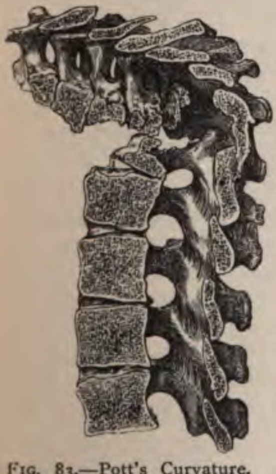

FIG. 83.—Pott's Curvature.

LATERAL CURVATURE OF THE SPINE

arises from debility of the ligaments and muscles, and is common among girls between the age of ten and sixteen years.

There is a perceptible *growing out of* one shoulder, or an elevation of one shoulder, more frequently the right; the spine is found, on examination, to be curved like an S and twisted on its long axis.

This deformity is usually produced by occupations that tax one side of the body more than the other, especially the habit *of standing at ease* on the right leg; it may also also be produced by one-sided postures in sitting or writing. This curvature is frequently produced by disease of the bones, as in rickets.

Treatment.—The general health of the patient is the first thing to be attended to; change of air, good diet, the different preparations of iron, bathing the body with salt and water every morning, are the remedies to be resorted to.

The patient should be kept out of doors as much as possible, and should be directed to take foot or horse exercise, but when not moving he should be required to lie down as much as possible, and not to sit upright. Mechanical support may be advisable in severe cases. Gymnastics and definite movements are beneficial.

ANGULAR CURVATURE,

known as *Pott's Curvature,* is produced by softening and absorption of the intervertebral substances, and caries of the bodies of the vertebræ.

Symptoms.—This disease usually begins with weakness, coldness, and numbness of the legs, and incapability of making exertion; these symptoms are followed by twitchings and spasms of the legs, and sometimes palsy. In adults, there is generally a dull, aching pain, aggravated by motion, and tenderness on pressure. If the patient slips when walking, he experiences great distress; this is one of the symptoms in children by which attention is called to their condition. If the disease is situated in the dorsal vertebræ, there will be tightness of the chest and difficulty of breathing; if the cervical vertebræ are affected, one or both arms may be palsied, and there will be difficulty in supporting the head. As the disease advances, the trunk becomes curved forward, and the spinous processes of the diseased vertebræ project backward. Abscesses may form; there is great constitutional derangement, with hectic flushes.

Treatment.—Rest in the horizontal posture is absolutely necessary. A bandage containing strips of whalebone, and reaching from the head to the hips, may be employed to keep the trunk at rest. Issues on each side of the spinous process of the diseased vertebræ may be used.

The constitutional treatment should be the same as that recommended for angular curvature, and for scrofulous cases generally.

Efficient mechanical support during convalescence is absolutely necessary; the plaster jacket of Dr. Sayre, of New York, is in general use, and the one most to be recommended.

AMPUTATIONS.

Amputations are operations for the removal of limbs. Disarticulations are amputations where joints are cut through and the member so removed.

General Considerations.—The principal causes that render amputations necessary are: Compound fractures with extensive laceration of the neighboring soft parts, involving the main artery, vein, or nerve of the limb; when a large joint is simplicated with extensive comminution of the bone; when gangrene presents itself; when a malignant tumor includes the bone; when great deformities exist; when there are extensively lacerated wounds produced by machinery, or the rending of animals.

In compound dislocations, when the question arises whether to resect or amputate, where the main artery, vein, or nerve is uninjured, the preference is given to resection. This rule especially applies to injuries of the shoulder, elbow, hip, and ankle. In like injuries of the knee the rule is to amputate, because the popliteal artery and the neighboring vessels are apt to be involved.

Amputations are performed by the *circular* or the *flap methods* and their modifications. When performing an amputation the rule is to cut the flap so that there will be skin enough to cover the muscle, and muscle enough to cover the bone; the width of the flap should be one-half the circumference of the limb, and its length should be one-half its diameter.

When using the saw to sever the bone, the edge must be steadied by the thumb nail of the left hand; the saw to be drawn from heel to point. When sawing through the bones of a limb that has two bones, the lesser bone is to be first cut through; by following this rule, the smaller bone is less apt to be split, and there is less likelihood of straining the articulation of the two bones.

The articles needed for an amputation are: A tourniquet, either that of Petit, or the Esmarch apparatus; amputation knives, cutting bone forceps, lion jaw forceps, tenaculum, hemostatic forceps, needles, Wyeth's pins, Horsley's antiseptic wax, consisting of beeswax seven parts, almond oil one part, and salicylic acid one part; sponges, and retractors.

The retractor consists of a piece of muslin from six to eight inches wide, from two to three feet long; if the amputation is on a limb containing one bone, the muslin is to be torn half way up into two tails; if the limb has two bones, the retractor is to be torn into three tails: the middle tail goes into the interosseous space. Before being used the retractor must be rendered thoroughly sterile.

Amputations are designated as Primary, Intermediate, or Secondary.

A Primary Amputation is one that is performed as soon as practicable after recovery from the shock of an injury.

An Intermediate Amputation is performed during secondary wound fever, whilst the temperature of the individual is still high. It is resorted to after an unsuccessful effort has been made to save the injured limb, when the patient's general condition will not permit postponement.

A Secondary Amputation is one performed after the subsidence of fever.

The prognosis is most favorable in primary operations, and the least so in intermediate amputations.

The methods of amputation are the Circular and the Flap.

The Circular.—When performing the circular amputation the operation is to be divided into three different steps: division of the skin and its separation from the underlying muscles; division of the muscles; division of the bone or bones.

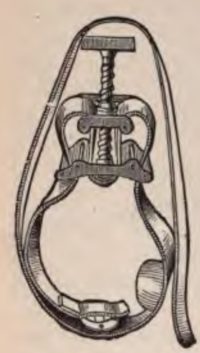

FIG. 84.—Petit's Tourniquet.

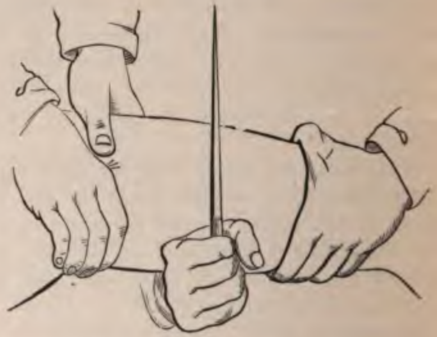

FIG. 85.—Circular Method.

When the operation is performed on the upper limb the section of the skin is to be made three inches below the point where the bone is to be sawed through; when on the lower limb four inches is to be allowed.

An assistant first draws the skin toward the trunk of the patient; the surgeon taking his knife in hand passes in beneath and behind the limb, and turning the instrument so as to face him he places the edge of the knife on the upper surface of the limb, as far forward as he can reach, and sweeps it entirely around the limb, describing a circle, and dividing the skin and cellular tissue. Separate the skin and cellular tissue from the deep fascia and turn it upward; the raw surface outward. The fascia and muscles are next cut through down to the bone by a circular cut, similar to that made when dividing the skin. The soft parts are now drawn up with the retractor; the periosteum is divided and reflected back as a cuff on the bone. The heel of the saw is placed upon the bone, and steadied by the thumb nail of the left hand, and drawn from heel to point to make a groove, it is then directed to and fro from point to heel, with a slight pressure until the bone is cut.

Flap Method.—The principal varieties of this method are: 1. Single Flap; 2. Double Flap; 3. Long Anterior Flap; 4. Long Rectangular Flap (Teale's); 5. Modified Flap; 6. Posterior Flap.

1. **Single Flap.**—This method is employed when injury or disease makes it impossible to obtain more than one flap. If possible it should be rectangular and at the same time wedge-shaped, and should include skin, fascia and muscle, the cut being either from without inward or by transfixion; the thin edge should be at the skin surface, and the base of the wedge at the point where the bones are to be cut. The flap should be a little longer than the transverse diameter, at the point where the bone is to be divided, which should be at least an inch above the base of the flap.

2. **Double Flap.**—These flaps are made either by transfixion, or by cutting from without inward. The flap farthest from the vessel is first made. The flaps may be antero-posterior or lateral. The incision may be made through the skin and fascia, when the muscles can be cut by transfixion; but as a rule it is better to cut the flaps from without inward than to transfix them. The breadth of the flaps should be half the width of the limb, and the length slightly more than the diameter of the limb at the point where the bone is to be sawn through.

3. **Long Anterior Flap.**—This is made of skin and cellular tissue, without any posterior flap. It forms a flat-faced stump. It is used in amputation of the knee, etc.

4. **Long Rectangular** (Teale's).—This is a long and short rectangular flap. The long flap is cut so that the large blood-vessels and nerves will not be included; it is, therefore, anterior on the leg and posterior on the forearm. The length and breadth of the long flap are equal to half the circumference of the limb where the bone is to be divided. The short flap includes the arteries and nerves, and is one-fourth the length of the long one. The flaps are marked out with ink and raised from

without inward, including the muscles. The bone is sawed at the angle of union. The long flap is bent so as to unite with the short flap, after the blood-vessels are tied.

5. **The Modified Flap.**—In this form the flaps include only the skin and cellular tissue. The muscles are divided at the base of the flaps, retracted, the periosteum divided, and the bone sawn through.

6. **The Posterior Flap** is chiefly used in amputation of the ankle joint, when Syme's operation is resorted to.

DISARTICULATION AT THE HIP JOINT.

This operation is requisite in cases of cancerous or hopeless disease of the femur, and in those injuries in which the upper extremity of the thigh bone is crushed and the soft parts so much damaged that it is useless to attempt excision.

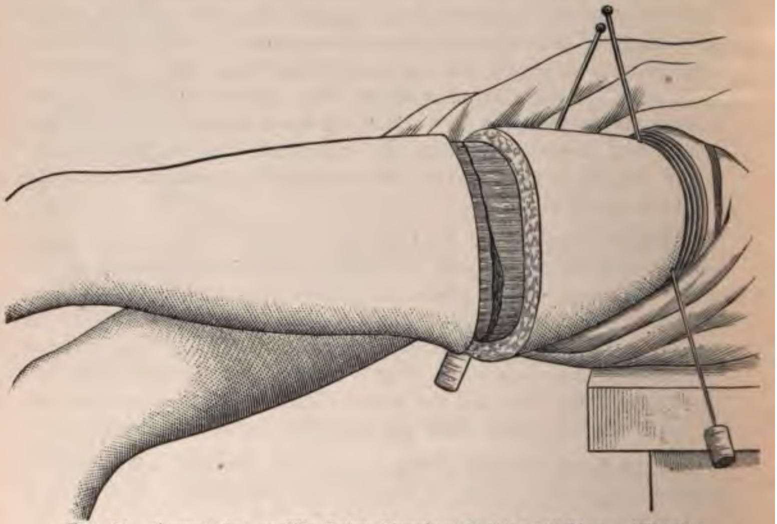

FIG. 86.—Amputation at Hip Joint Showing Position of Pins. (*Wyeth.*)

It is generally performed by flaps, either antero-posterior, lateral, or circular.

The *arteries* divided in this operation are the *muscular* and *femoral*, lying close together inside and in front of the bone.

The *internal circumflex* is also divided, and also the *external circumflex.* The great sciatic nerve and an accompanying branch of the ischiatic artery lie in the posterior flap, near its centre.

Wyeth's Bloodless Method.—Bring the hip well over the edge of the table, and apply Esmarch's bandage as high as possible; then take a Wyeth pin and insert it at a point one and a half inches below and slightly to the inner side of the anterior-superior spinous process of the ilium, pass the pin through the tissues about half way between the trochanter major and the iliac spine, external to the neck of the femur, so that the point will emerge just back of the trochanter. Pass a second pin an inch below the crotch and internal to the saphenous opening, so that the point will come out about an inch and a half in front

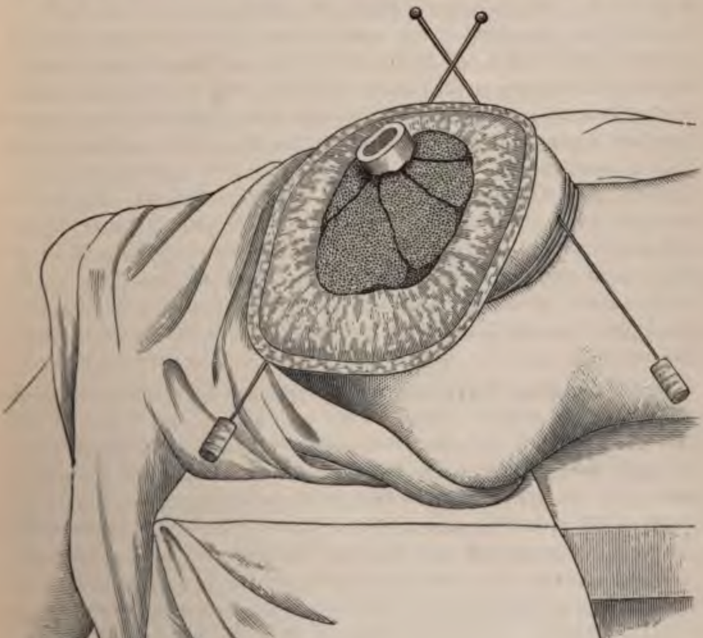

FIG. 87.—Amputation at Hip Joint. (*Wyeth.*)

of the tuber ischii; protect the points of the pins with cork; then pass a long piece of black pure rubber tubing half an inch in diameter, tightly around the limb, above the needles, tying or clamping it. Remove the Esmarch bandage, and examine the femoral artery to ascertain if the circulation has ceased; if it has not, tighten the India rubber tube sufficiently to have it under complete control.

Six inches below the pins make a circular incision down to the deep fascia, the circular incision is joined by a longitudinal cut through the skin and fascia commencing at the constricting band. Reflect back the skin and fascia to the level of the trochanter minor; at this point make a circular sweep with the knife, dividing the muscles to the bone at a much lower level than the trochanter minor, which gives the operator a handle wherewith the subsequent resection of the bone is rendered more simple. Secure all visible vessels, loosen the rubber band, tie all bleeding points. Then open the capsule and disarticulate the bone; this is facilitated by carrying the bone directly upward, forward, and inward, causing luxation to occur, when the ligamentum teres can be readily divided. Control all hemorrhage in the usual manner, bring the flaps in apposition by means of sutures, place the drain externally, and dress with plenty of sterile gauze to absorb the drainage.

Senn's Bloodless Amputation.—The external incision is made about eight inches in length, parallel to the long axis of the femur, directly over the center of the great trochanter, extending three inches above its upper border. When the knife reaches the trochanter from above downward, its point should be kept in contact with the bone the whole length of the remaining part of the incision. The margins of the wound are now retracted and any spurting vessels, such as the circumflex arteries, secured. The trochanteric muscular attachments are now severed close to the bone with a stout scalpel. The thigh is then flexed, strongly adducted and rotated inward when the capsular ligament is divided transversely at its upper and posterior aspect. The remaining portion of the capsular ligament is severed while the thigh is brought back to a position of slight flexion. After complete division of the capsular ligament the thigh is rotated outward, and if possible the ligamentum teres is divided; if this cannot be readily done the head of the bone is forcibly dislocated upon the dorsum of the ilium by flexion, adduction and rotation inward of the thigh. After dislocation has been effected, the trochanter minor and upper part of the shaft of *the femur* are cleared by using alternately scalpel and periosteal elevator

By pushing the femur through the opening as much of the shaft can be cleared as may be desired for the purpose of making a low amputation.

Elastic constriction applied as here indicated will prevent further loss of blood: Bring the limb down in a straight line with the body, flex the thigh slightly, insert long, stout, hemostatic forceps into the wound behind the femur and on a level with the trochanter minor; push the instrument inward and downward in a direction about two inches below the ramus of the ischium and just behind the adductor muscle. When its point is felt under the skin make an incision about two inches in length, through which the instrument is made to emerge. Enlarge the tunnel with the forceps, then with that instrument draw along the tunnel a piece of sterile rubber tubing, three-quarters of an inch in diameter, and about three or four feet in length, withdrawing the forceps. The tubing having been grasped in its middle by the forceps, it is cut in two at that point. The anterior segment of the thigh is to be constricted sufficiently to completely interrupt both the arterial and venous circulation. Prior to constriction the limb is rendered bloodless by elastic compression and by keeping it in a vertical position for a few minutes. After having secured the necessary constriction, the elastic tubes are caught and held in a pair of strong forceps at a point where they cross each other. The posterior segment of the thigh is constricted by the remaining rubber tube, which is drawn tightly behind.

Muscular flaps should be avoided in this amputation; if the conditions for which the amputation is made permit, a long oval anterior and short superior skin flaps should be made, which are best adapted for a useful stump and efficient drainage. In making the anterior flap the incision is commenced at the lower terminus of the straight incision; dividing the tissues down to the muscles it is carried downward in a gentle curve across the anterior aspect of the thigh, embracing two-thirds of its circumference; it is then carried upward to a point on the inner side just below the opening of the skin occupied by the constrictors. The posterior flap is made in a similar manner, but about one-third shorter. The flaps including the deep fascia are reflected to the point where the muscles are to be divided; they are to be held out of the way whilst the amputation is being completed.

The incision through the muscles should be slightly conical; the apex of the cone pointing upward. The sciatic nerve is to be resected to the extent of an inch, and the arteries tied with catgut in the usual manner. The femoral artery and vein are now isolated and a catgut ligature, including both of the vessels, applied half higher up. The vein is thus ligated and the artery is secured by a double ligature.

During the operation the body of the patient is drawn down so that the pelvis rests upon the lower edge of the table, that the position of the thigh can be conveniently changed by the assistant who is entrusted with this work.

AMPUTATION OF THE THIGH.

The **Circular,** or **Flap Method** may be employed at the option of the operator.

Circular Method.—The surgeon stands at the outer side. One assistant must hold the limb, and another must draw up the skin as high as possible. Then the surgeon, grasping firmly the knife, with the point upward and the edge toward his arm, commences by passing his arm under the limb, laying the edge of the knife over it, and makes a transverse incision at one sweep, completely around the limb, through the skin and fat, down to the fascia.. The knife cuts from heel to point. The assistant now draws upon the skin and folds it back like a coat cuff; and then the knife, being put close to the edge of the retracted folded skin, is made to divide the superficial vessels, and then cut everything down to the bone by a clear sweep. Then separate the muscles upward from the bone, for an inch or two, with the point of a knife, and divide the periosteum. The soft parts are next to be drawn up from the bone by the *retractor,* and lastly, the bone is to be divided by the saw. Should the bone be splintered, the projecting parts must be removed by the bone forceps. The femoral artery must now be secured, its orifice being grasped and slightly drawn out by the forceps; and afterward any large branches that appear in the muscular interstices. Then all compression should cease, so that arteries that are likely to bleed should do so. When the bleeding has finally ceased, the edges of the wound should be adapted with sutures, and a few long slips of plaster and a light bandage passed around the stump. The arteries divided are the *femoral,* the *profunda,* and the descending branches of the external circumflex.

Flap Operation.—The operator may stand on either side of the limb. In amputating the right thigh, he stands on the outer side and raises the flap with the left hand, and this gives him the power of grasping the main artery, with the flap, with that hand, and thus assisting in restraining hemorrhage. The flaps should be semilunar in shape, *and should* be of the same size; they should be cut from the lateral or antero-posterior aspect of the limb; the latter method is advised; they may be cut from without inward, or by transfixion; probably the best method is to cut semilunar anterior and posterior flaps through the skin and fascia to the muscles; each flap to be in width one-half the circumference of the limb at the point where the bone is to be divided. The length of the flaps should be rather longer than the semilunar diameter. After the skin flaps are made the surgeon inserts a long amputating knife at the outer side, at the angle formed by the two flaps, and pushes it through the tissues until it reaches the bone; he then depresses the handle slightly to pass over the bone, carries the blade on until its point protrudes at the junction of the flaps on the opposite side; he then carries the knife on for about three inches, and in order to bevel the flap so that it will be spade-shaped without corners, he cuts forward and outward, and when he has secured a sufficient length he turns the knife so that it will *cut directly outward*, by which means the flap will be neatly bevelled; thick at the base and thin at the edge. The posterior flap is cut in the same manner. The vessels are then secured, the tourniquet removed, the flaps coaptated and care taken to secure proper drainage.

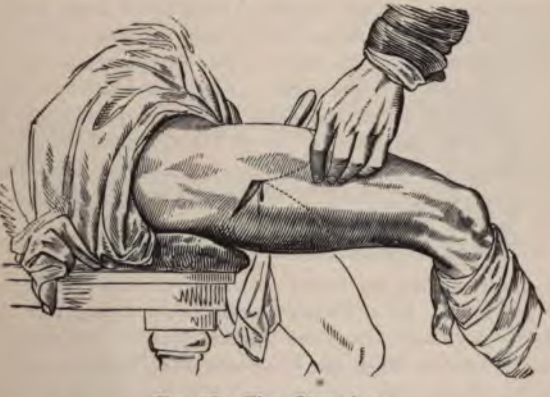

FIG. 88.—Flap Operation.

To insure the uniform width of the flaps, it is well to mark on each side of the limb a point denoting half the circumference of the limb, then placing the index finger on one side and the thumb on the other point, the operator cuts from thumb to finger.

The Modified Flap.—Two equal semilunar flaps of skin are raised from the fascia, the one anterior and the other posterior. The bases of the flaps must be equal, that is, each must embrace half the circumference of the limb, the convexities being toward the knee, and retracted two inches further; the muscles are cut directly down to the bone by a circular sweep of the knife. The bone is cleaned and sawn through two inches higher than where it was first exposed by the anterior incision through the muscles.

AMPUTATION AT THE KNEE JOINT.

Long Posterior Flap (Syme's Operation).—A semicircular incision is made through the skin and fascia, over the middle patella. Cut down to the bone and retract the flap. Incise the quadriceps above its patellar attachment. Next thrust a long knife horizontally across immediately behind the joint and cut a posterior flap eight inches long from the calf of the leg. The anterior flap being lifted up, the extensor muscles are severed from the upper border of the patella; the remaining soft parts are divided, and the femur sawn through the condyles, immediately above the joint.

For a description of the amputation of Gritti and the operation devised by Sabanepff the student is referred to the text-books.

DISARTICULATION AT THE KNEE JOINT.

Long Anterior Flap Operation.—An anterior flap may be made, including the patella, by a semicircular incision through the tissues in front, below the patella, from the posterior part of the condyle of the femur to the other. Then the *ligamentum patella* is cut through, the patella lifted with the anterior flap; the joint opened by cutting through the lateral and crucial ligaments, and a posterior flap cut from the calf.

The interarticular cartilages should be removed, and the surface of the patella and the femur, only if diseased. Some surgeons bring down the patella over the femur; others remove it.

The arteries divided are the *anterior and posterior tibial, sural* and *articular* branches.

AMPUTATION OF THE LEG.

Kocher's Disarticulation.*—Place the leg in slight flexion making an angle with the thigh of 135 degrees. An oblique incision starting in the crease posterior to the joint is carried downward to a point four fingers breadths below the tibial tubercle and upward to the crease on the opposite side. This insures a long anterior flap recommended by Kocher than whom we feel there is no greater master.

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* "Kocher's Text-book of Surgery," translated by Harold J. Stiles.

The "point of election" for amputation of the leg is three inches below the tubercle of the tibia; it is not recommended to preserve the limb beyond this, as a longer stump undoubtedly interferes with the comfortable use of the artificial limb now in vogue.

The operation is applicable to any portion of the leg below the knee joint to a point within three inches of the ankle, and probably the one to be most recommended is that known as the "antero-posterior flap," the two flaps being of the same length; that of the anterior being cut from without inward, and the posterior being procured by transfixion.

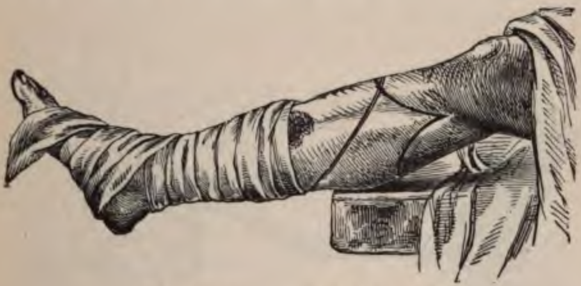


FIG. 89.—Amputation of the Leg.

The patient is brought well to the edge of the table; the limb to be removed is laid upon a pillow, supported at the heel by an assistant. The operator places the thumb of the left hand on a point just below the fibula, and the index finger a little below the line of the internal border of the fibula; with these points as guides, a semilunar flap is cut, somewhat longer than half the diameter of the limb, through the skin and fascia; this is dissected back to the points where the index finger and thumb of the left hand rest; a transfixion knife is then entered just below the fibula, and being carried through the tissues, is made to protrude on the other side, opposite the point of entrance, when a posterior flap is cut of the same length as that for the anterior. Any muscles which have not been divided are to be severed by a circular sweep of the knife; the interosseous space is divided, the periosteum pushed back, and the bones sawn through. After the limb has been removed saw off the sharp edge of the tibia and cut off half an inch of the fibula, which insures a better stump. Secure the vessels, apply necessary drainage, and close the wound in the usual manner.

Double-flap Method, at the upper fourth of the leg. A stout bistoury, with blades four or five inches long, and a broad saw, are the cutting instruments required. The flaps are made of integuments only, by cutting from the surface without transfixion. The point of the knife is entered at the side, about two inches below the tibial tubercle, and carried across the front of the leg, describing an anterior curved flap, rather longer than, and of the exact width of, the half diameter of the limb. This is dissected up close to the bones and deep fascia. A similar flap is made on the posterior aspect, and the integuments and fascia composing it are raised from the muscles. The latter, with the large vessels and nerves, are then divided transversely, direct to the bone. The point of the knife must be used to divide the intervening structures. The bones are then divided, equally across.

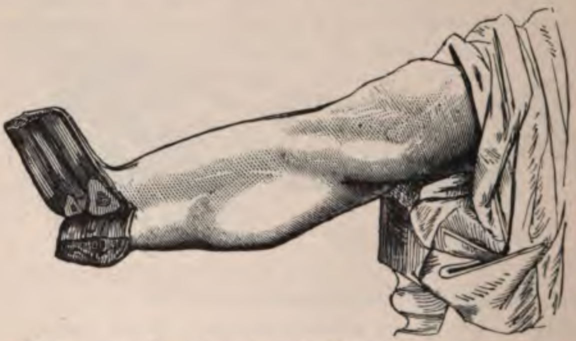


FIG. 90.—Long Anterior and Short Posterior Flap.

The *anterior tibial artery* is often divided as it passes between the bones to the front of the leg, and it may be difficult to get it separated from the surrounding ligamentous structures.

Single-flap Operation.—The operator places the heel of the knife on the side of the limb furthest from him, then draws it across the front of the limb, cutting a semilunar flap of skin; when its point arrives at the opposite side, it is made to transfix the limb, and then the posterior flap is cut. Care must be taken not to get the knife between the bones when making the flap by transfixion. The muscles and ligamentous structures which are between the bones are then divided by the point of the knife. The fleshy mass of the gastrocnemius may require to be cut out, to make the posterior flap thinner.

The Circular Operation is especially adapted to removal of the leg at the lower third of its length. One assistant supporting the foot, and another holding the knee, and at the same time drawing up the skin, the surgeon makes a circular incision through the skin, four inches below the point where the bones are to be divided. The integuments are then dissected up for two inches and turned back, and the muscles divided down to the bone by a second or third circular incision. A catlin is then passed between the bones to divide the interosseous ligament and muscles, and both bones sawn through together, the flesh being protected by a three-tailed retractor, the middle tail passing between the bones; to prevent splintering, the division of the fibula should be completed before that of the tibia. The *anterior* and *posterior tibial* are the principal arteries requiring ligatures.

DISARTICULATION AT THE ANKLE JOINT. (Tibio-tarsal Articulation.)

Syme's Operation.—Find the tip of the external malleolus, and then mark a point nearly opposite to it on the inner side of the ankle. This is about half an inch below and behind the internal malleolus; these points are joined by two incisions, one passing vertically under the sole of the foot and the other over the dorsum, so as to make an angle of 120° with the first. The first incision should be inclined backward rather than forward, so that the lower flap may be very short; the next step is to dissect the lower flap from the os calcis, including the tendo-Achillis. When this is done the short upper flap is dissected from the dorsum. The foot is then forcibly extended, the ankle joint opened and the foot removed. The malleoli and a thin slice of the articulating surface of the tibia are then sawn off and the fla brought together with sutures.

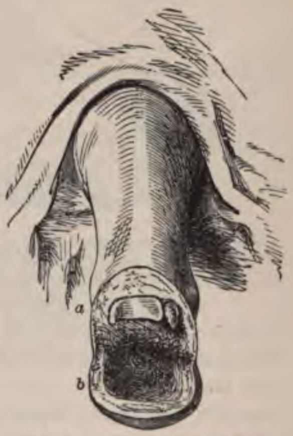


Fig. 91.—Syme's Operation.

Pirogoff's Amputation.—Instead of dissecting out the entire os calcis, Pirogoff removes the anterior part only of the bone, which supports the astragalus.

In this amputation the first incision is begun close in front of the malleolus and carried straight down to and transversely across the sole of the foot, then obliquely upward and forward to the front of the inner malleolus, dividing everything down to the bone. The incision is then brought obliquely forward on the inner side, so as to cut the *posterior tibial* artery before its division into its *plantar* branches. The ends of this incision are connected by a semilunar one across it into the ankle joint. Then the lateral ligaments are divided and the posterior part of the capsule; with a narrow saw the os calcis is now cut obliquely from behind forward and downward. Then the malleoli are sawn off, with a thin slice of the tibia, if diseased. Lastly, the cut surface of the os calcis is brought into contact with that part of the tibia, and the wound is united with sutures.

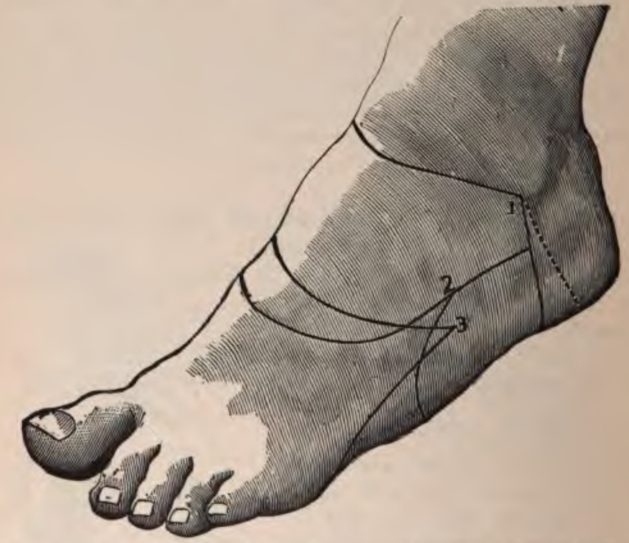


FIG. 92.—1, Incisions in Pirogoff's Operation; dotted line shows the direction of the plantar incision in that of Syme. 2, The incision is subastragaloid. 3, Those in Chopart's Amputation. (*Jacobson.*)

AMPUTATION OF THE FOOT.

Amputations of the Toes at any of their joints is performed in precisely the same manner as amputations of the fingers. In removing a single toe from its metatarsal bone, the surgeon should take care to ascertain the exact situation of the joint, which lies rather deeply and much further back from the prominent knuckle of the toe than is at first sight apparent. If possible the head of the metatarsal bone should not be removed, if it can be avoided, as it is important to preserve the breadth of the foot.

Amputation of all the Toes at their Metatarsal Joints.—Performed by first making a transverse incision along the dorsal aspect of the metatarsal bones, dividing the tendons and lateral ligaments of each joint in succession; and then the phalanges being dislocated upward, the knife is placed beneath the metatarsal extremities and made to cut out a flap from the skin on the plantar surface, sufficient to cover the heads of the metatarsal bones.

Amputation of the Metatarsal Bone of the Great Toe.—An incision with a scalpel is carried along the dorsum down to the bone and around the root of the toe. Then the knife is kept as close to the bone as possible, dissecting it out from the surrounding parts. Then the bone is removed at the metatarso-cuneiform joint, by division of the tendons and ligaments.

DISARTICULATION AT THE TARSO-METATARSAL ARTICULATION (Lisfranc's Operation).

Directions for Locating the Tarso-metatarsal Articulation.—Find the articulation on the outer side, by locating the prominence at the base of the metatarsal bone of the little toe, which indicates the position of the articulation between the metatarsal and cuboid bones. Draw a line from the base of the metatarsal bone of the little toe directly across the instep, advance forward from this point half an

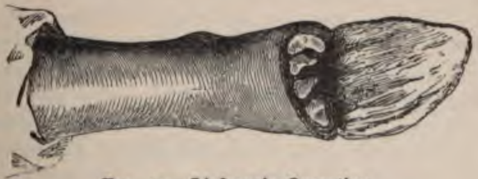


Fig. 93.—Lisfranc's Operation.

inch, which gives the point of junction between the metatarsal bone of the big toe and the internal cuneiform bone.

The exact situation of the articulation of the great toe to the *inner cuneiform* bone being ascertained, a semilunar incision with the convexity forward is made through the tegumentary structures across the instep, from a point just in front of the aforesaid articulation to the outside of the tuberosity of the fifth metatarsal bone. This flap is turned back and the bistoury is first to be passed straight across the tendons and vessels, so as to cut them a little shorter than the integuments, and then around behind the projection of the fifth metatarsal bone, so as to divide the external ligaments which connect it with the cuboid. The dorsal ligaments are next cut through, the bones being at the same time well depressed. The third and fourth are to be disarticulated in a similar manner. The first metatarsal is next attacked, and lastly the second, the extremity of which, being locked in between the cuneiforms, will be more difficult to dislodge. When all the five bones are disarticulated, the surgeon completes the division of the plantar ligaments and separates the textures which adhere to them with the point of the knife, and then, the foot being placed horizontally, he puts the blade under the five bones and carries it forward along their inferior surface as far as the root of the toes, so as to form a sufficient flap.

Hey's modification of Lisfranc's operation consists in sawing off the *projection of the internal cuneiform bone,* and thus forming a regular surface.

DISARTICULATION THROUGH THE MEDIO-TARSAL ARTICULATION (Chopart's Operation).

To remove the navicular and cuboid bones, with all parts in front of them.

Directions for Locating the Medio-tarsal Articulation.—Measure back half an inch from the prominence at the base of the fifth metatarsal bone, which gives the point of articulation between the cuboid bone and the os calcis; draw a line from this point directly across to the inner aspect of the foot, which will indicate the point of junction between the scaphoid and astragalus.

In the first place, the articulation of the *cuboid* with the *os calcis,* and that of the *scaphoid* with the *astragalus,* must be sought for, and a semilunar incision must be made across the dorsum from one to the other, as in the foregoing operation. The flap of the skin being turned back, the internal and dorsal ligaments that connect the *scaphoid* to the *astragalus* are to be divided with the point of the bistoury. The ligaments connecting the *os calcis* and *cuboid* are next divided, and lastly a flap is taken from the sole of the foot. If the heel is drawn backward it may become necessary to divide the tendo-Achillis.

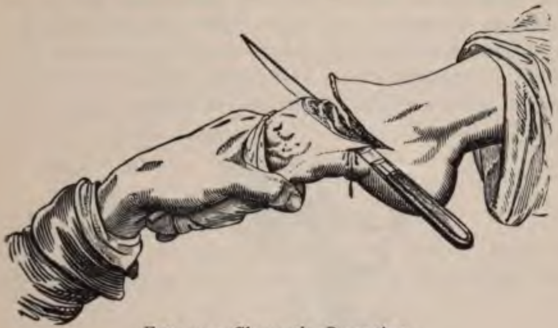


FIG. 94.—Chopart's Operation.

In these amputations the *dorsal region* of the foot, and the external and internal plantar branches usually require ligatures.

DISARTICULATION OF THE SHOULDER JOINT.

The Flap Method.—The patient is placed on a firm table, with the arm well raised and projecting beyond its edge; the subclavian artery being compressed, the operator enters a long, narrow, straight bistoury at the anterior margin of the deltoid muscle, if it be the right arm, an inch below the acromion. From this point he thrusts it through the muscle, across the outside of the joint, and brings it out at the posterior margin of the axilla.

If the left arm is operated on, the knife must be entered at the posterior margin of the axilla, and brought out at the anterior margin of the *deltoid*. Then, by cutting downward and outward, the external flap is made. The arm is then brought down to the side and forcibly adducted; the origins of the *biceps* and *triceps* and the insertions of the *infra-* and *supra-spinatus* are cut through and the joint laid open. Finally the blade of the knife, being passed through the joint and placed on the inner side of the head of the bone, is made to cut an inner flap of the same shape, but rather shorter than the outer one.

touched. The flaps are then dissected back, including the
sing the joint. The head of the bone is then dis-
upon the tuberosities; the arm being rotated
rm is then adducted, throwing the head
knife passed to the inner side and
one, an assistant at the same time
the tissues between the axillary folds
from within outward, so as to form

of the *anterior* and *posterior circumflex*
require to be tied.

UTATION OF THE ARM.

the upper extremity the flow of blood may be
by digital compression of the artery above the

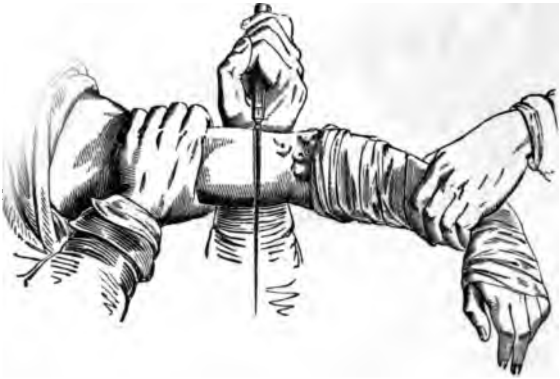


FIG. 96.—Circular Amputation.

vicle, or in the arm against the humerus. Or the tourniquet, or march's band may be applied.

Circular Amputation.—The arm being held out, and an assistant wing up the skin, one circular incision is made through the integunts, which being forcibly retracted and detached from the deeper uctures and doubled back to the extent of two inches, another is de to the bone. The subsequent steps are precisely similar to those amputation of the thigh.

Oval Method (Larrey's Bloodless Method).—In order to control hemorrhage pins similar to those already described for amputation of the hip joint are now employed. The anterior pin is inserted at the middle of the lower margin of the anterior axillary crease and emerges about one inch within the acromion process. The posterior pin is entered at the same point on the posterior axillary crease and emerges one inch posterior to the acromion. The points are to be protected by cork. The rubber band is to be put on above the line of operation, which is to be removed as soon as the limb is amputated and the vessels secured. Make a straight incision immediately beneath the acromion process, and a little toward the anterior border of the axilla, with a moderate-sized amputating knife, which should reach down to the bone, and should be between three and a half to four inches in length; from the lower end of this incision two others are prolonged, the first passing in a curved direction downward and backward, and the second forward toward the folds of the axilla; the blood-vessels and the inner or axillary aspect of the arm

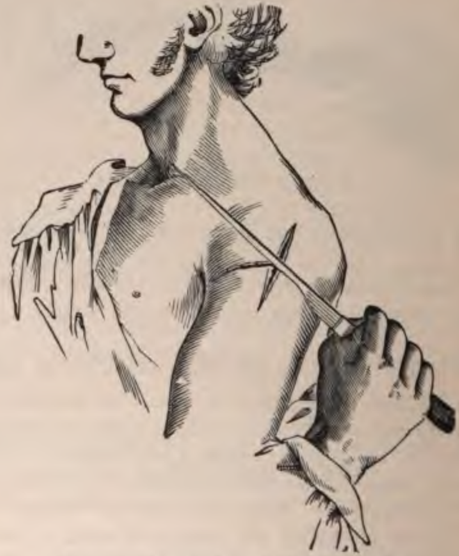


FIG. 95.—Amputation of Shoulder Joint.

remaining untouched. The flaps are then dissected back, including the muscles and exposing the joint. The head of the bone is then disarticulated by cutting upon the tuberosities; the arm being rotated inward and outward. The arm is then adducted, throwing the head of the humerus outward, and the knife passed to the inner side and carried downward close to the bone, an assistant at the same time compressing the artery. Then the tissues between the axillary folds are divided by an oblique cut from within outward, so as to form part of the internal incision.

The axillary, and branches of the *anterior* and *posterior circumflex and supra-scapular arteries* require to be tied.

AMPUTATION OF THE ARM.

In amputations of the upper extremity the flow of blood may be sufficiently controlled by digital compression of the artery above the clavicle, or in the arm against the humerus. Or the tourniquet, or Esmarch's band may be applied.

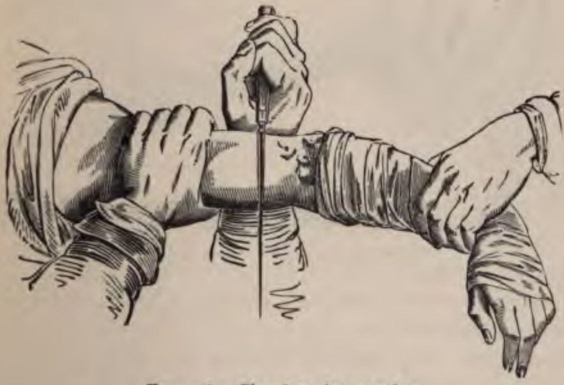


FIG. 96.—Circular Amputation.

1. **Circular Amputation.**—The arm being held out, and an assistant drawing up the skin, one circular incision is made through the integuments, which being forcibly retracted and detached from the deeper structures and doubled back to the extent of two inches, another is made to the bone. The subsequent steps are precisely similar to those described in amputation of the thigh.

2. **Antero-posterior Flaps.**—The knife is extended at one side and carried down to the bone, turned over it, brought out to a point opposite and then made to cut a neat rounded anterior flap, three inches long. The knife is next carried behind the bone to make a posterior flap of equal length, and is lastly swept around the bone to divide any remaining fibers with the periosteum; the vessels are cut when the posterior flap is being formed. The division of the bone, ligature of the arteries and treatment of the stump as heretofore.

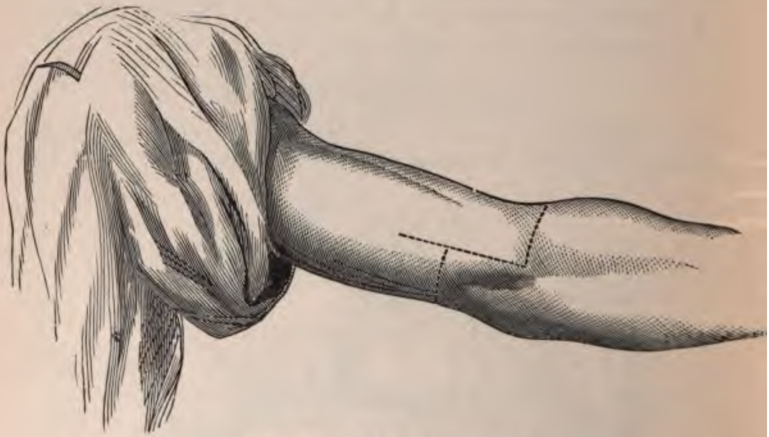


Fig. 97.—Teale's Amputation.

Besides the *brachial artery,* the *superior profunda* and the *inferior profunda* require ligatures.

3. **Rectangular Flap Method** (Teale's Amputation).—This method of operation is chiefly advisable in cases of injury attended with great loss of soft parts.

The long anterior flap must be made so that the inner line of incision shall be sufficiently near the margin of the biceps muscle not to involve the brachial artery. The short flap is to be taken from the posterior aspect of the limb.

DISARTICULATION AT THE ELBOW JOINT.

1. **By an Anterior and Posterior Flap.**—The arm being extended, the surgeon cuts a semilunar anterior flap, three inches in length, from

the internal to the external condyle; then slightly flex the arm and cut a posterior flap of the same width and length.

The anterior flap is to be raised from the bones as far as the line of articulation; the external lateral ligament is next divided; the knife is then passed into the joint between the head of the radius and the external condyle. Divide the internal lateral ligament and dissect the posterior flap back a little beyond the end of the olecranon process, when it can be easily disassociated from the socket, and then by a few touches of the knife the limb is severed. Secure the arteries and adjust the flaps.

2. **Circular Operation.**—Make a transverse incision three and a half inches below the inner trochlea. Raise the skin and fascia for an inch, then divide the muscles circularly. Forcibly retract these; again divide the deep muscles transversely, together with the external lateral ligament, on a level with the radial articulation. The head of the radius is recognized and the joint opened by entering the knife between the radius and humerus, dividing the external ligament. The olecranon is then drawn forcibly downward, and the triceps divided at its insertion, and the remaining tissues from within outward.

AMPUTATION OF THE FOREARM.

Always perform this operation as near the wrist as possible.

1. **Circular.**—The limb being supported with the thumb uppermost and an assistant drawing up the skin, a circular incision is made through it, down to the fascia. When the integument is retracted and folded back about an inch, the muscles and tendons are divided by a second circular incision; the interosseous parts and the remaining fibers are next cut through; the bones are then sawn through together and of equal length, and projecting tendons trimmed off. The *radial, ulnar* and one or two *interosseous* arteries require ligatures.

2. **Flaps.**—The limb being placed in a state of pronation, the surgeon makes a flap from the extensor side by cutting from without inward; the flap should be in width one half the circumference of the limb at the point to be removed; its length should be a little more than its semi-diameter. The posterior flap is to be of the same size and made in the same manner as that for the flexor side. The interosseous parts are then divided, the flesh drawn upward, the bones sawn through, and the tendons trimmed off. The vessels to be secured are the radial, ulnar and interosseous arteries, and probably some of their muscular branches.

3. **Long Rectangular Flap** (Teale).—This flap is made from the back of the forearm. The radial vessels are included in the shorter flap. In tracing the long flap, a longitudinal line is drawn over the radius external to the vessels; at the distance of half the circumference of the limb another line is drawn parallel over the ulna. These are joined across the dorsum by a transverse line. The short flap is formed by a transverse line across the front, joining the long ones at the upper fourth. When dissecting the long flaps from below upward, the tissues must be separated close to the periosteum and interosseous membrane, and the bones sawn through at the angle of union. The vessels having been ligated, the stump is to be placed in the prone position, so that the long flap may fall over the ends of the wound and be approximated to the short flap, in the usual method.

DISARTICULATION AT THE WRIST.

1. **Circular.**—The skin being pulled back, a circular incision is made a little below the level of the line that separates the forearm from the palm of the hand. The integument must be turned back as far as the line of the radio-carpal joint. The external lateral ligament is then cut through, and the knife carried across the joint to divide the remaining attachments. The styloid process of the radius and ulna should be removed with the cutting forceps, the tendons trimmed and the integuments brought together with sutures.

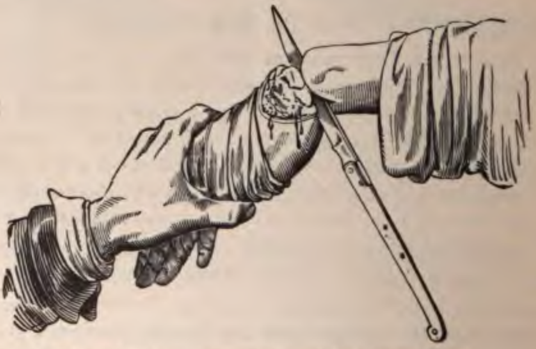


Fig. 98.—Flap Amputation of the Wrist Joint.

2. **Flaps.**—A semilunar incision is made across the back of the wrist, its extremities being at the styloid processes, and its center reaching

down as far as the second row of carpal bones. Dissect up the flap of integument and fascia, flex the hand, and divide the extensor tendons across, opposite to the joint. The joint being opened behind, and the lateral ligaments cut through, and the knife being placed between the carpus and forearm, is made to cut out a flap from the anterior surface of the palm.

DISARTICULATION OF THE FINGERS.

Fingers and Toes are disarticulated by flap methods. At the metacarpo- and metatarso-phalangeal articulations, by the oval method, so that the resulting scar may not be on the palm of the hand nor on the sole of the foot.

When disarticulating at the metacarpo-phalangeal articulation of the thumb or little finger, or at the metatarso-phalangeal articulations of the great and little toes, the wound is made in such a manner that the scar will be on the side of the hand or foot. In the removal of the remaining fingers and toes at the articulation, the cut is made so that the scar will be on the back of the hand or foot and between the adjacent bones.

When disarticulating fingers it is to be borne in mind that the joint in the last row of the phalanges is one-twelfth, the middle row one-sixth, and the metacarpo-phalangeal articulation one-third of an inch back of the most prominent part of the knuckle.

When disarticulating a finger the anterior and posterior flaps must be of the same size; the finger must be alternately extended and flexed until the exact position of the joint is ascertained; the knife is then entered at the side of the finger at the articulation and carried down to the bone; a straight incision is then made a little over a quarter of an inch in length, and a like incision made on the opposite side; the ends of these cuts are joined by a circular sweep. Then dissect up

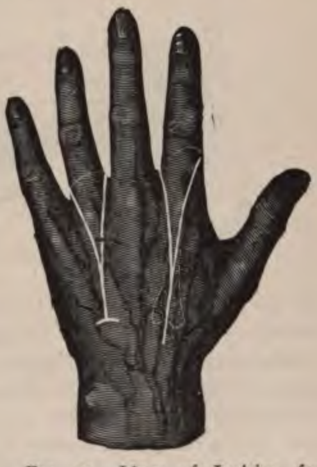


FIG. 99.—Lines of Incision for Resection of Metacarpal Bones. (*Veau.*)

the anterior and posterior flaps and disarticulate the joint; draw down and cut off the tendons and close the wound. Ligatures are unnecessary, as the sutures will control hemorrhage.

Disarticulations of the fingers or thumb at their distal joints are performed by the operator holding the phalanx firmly between the finger and thumb and bending it, so as to give prominence to the head of the middle phalanx. He then makes, with a scalpel, a straight incision across the dorsal skin, over the head of the middle phalanx, along the distal groove of the knuckle, so as to cut into the joint deeply enough to divide the lateral ligament. The knife is carried through the joint, and cuts a flap from the palmar surface of the last phalanx, sufficient to cover the head of the bone.

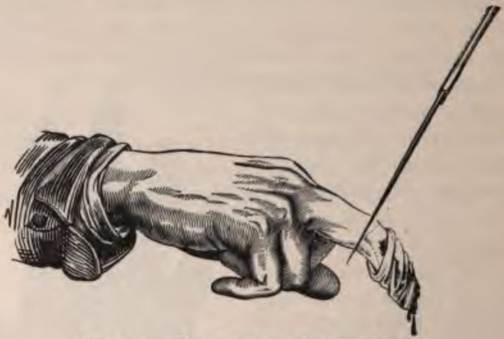


FIG. 100.—Aumptation of the Fingers.

Disarticulation of the Finger at the Metacarpo-Phalangeal Articulation.—While an assistant supports the hand and remaining fingers, the surgeon grasps the finger to be removed and makes firm extension; then with a sharp and narrow bladed knife he starts the incision one-third of an inch back of the most prominent part of the knuckle, extending the cut across the joint as far as the web of the finger, where it is made to deviate from a straight course, passing first laterally on the inside and then to the outside; the incision to be joined on the palmar surface, making an oval cut down to the bone. The joint is opened from the front and disarticulated. The vessels are next secured and the flaps approximated.

Disarticulation of the Metacarpal Bone of the Thumb.—*By anterior flap operation.* Hold the thumb out; insert the bistoury near the metacarpo-phalangeal joint; its point is thrust between the bone and the muscles of the ball of the thumb, and as close to the bone as possible, and brought out just above the articulation with the trapezium. The bistoury is then made to cut its way outward, and the point of the knife is carried from the upper end along the bone, and around the metacarpo-phalangeal joint, to meet the other incision. The bone is disarticulated by being forcibly abducted, and the ligaments on the inner side of the metacarpo-trapezial joint cut through first.

Disarticulation of the Metacarpal Bone of the Little Finger.—An incision is made along the ulnar border of the dorsum of the bone, and carried around to encircle obliquely the root of the little finger. The skin and flesh are dissected off, as closely as possible to the bone, and the bone is disarticulated, by the point of the knife, from the unciform, while the ligaments are stretched to their utmost by extreme abduction.

After the disarticulation or amputation of any portion of the hand, a splint should be used when dressing the part.

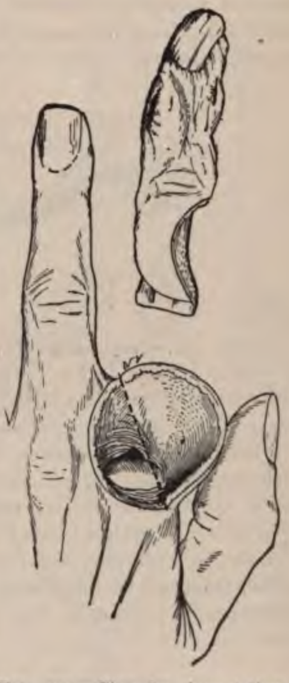


FIG. 101.—Flap for Amputation of Index Finger. (*Veau.*)

EXCISION OF JOINTS.

When joints are hopelessly diseased, or so extensively injured as to threaten the life of the individual, and render repair impossible, cutting out the portion of diseased or injured bone is resorted to instead of amputation.

It is now well established that in many joints, excision is better and safer than amputation; less violence is done to the body; fewer great arteries, nerves and veins are divided, and the patient is left with a limb, which, although imperfect, is in most cases highly useful.

EXCISION OF THE SHOULDER JOINT.

Surgeons differ as to which is the best incision to make in commencing this operation; many authorities recommend an anterior, in front of the deltoid. Bryant advocates a vertical incision from the acromion process, through the thickness of the deltoid down to its insertion.

Make the vertical incision down to the bone, rotate the head of the humerus successively outward and then inward; then make a transverse cut across the tuberosities to divide the insertions of the scapular muscles. Divide the capsule; turn the head out of the wound, and resect through the tuberosities. Should the glenoid cavity be diseased, the dead bone must be removed.

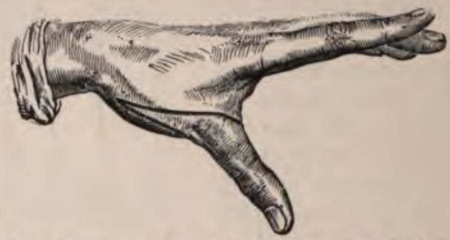


FIG. 102.—Amputation of the Metacarpal Bone of the Thumb.

When the vertical incision is employed, an opening must be made posteriorly through the soft parts, at a point corresponding to the upper end of the humerus, for the purpose of drainage; it must be kept open by means of a drainage tube.

After the operation, the arm should be abducted and placed on a pillow, the edges of the wound carefully brought together, and dressed antiseptically. Three or four months are required to secure a useful arm.

EXCISION OF THE ELBOW JOINT.

The patient is laid on his back, and the arm held with the hand in a prone posture by two assistants, one of whom holds the arm and the other the forearm. A straight vertical incision, four inches long, through the skin and subcutaneous tissues, is then made a little to the ulnar side of the hinder surface of the joint; its center about the level of the olecranon, and to the outer side of the groove wherein the ulnar nerve lies. Deeper cuts are then made round the upper border and sides of the olecranon, laying bare the condyles of the humerus, and separating the origins of the muscles of the forearm, and cutting into the joint transversely, severing the triceps from the olecranon. The ulnar nerve is drawn inward, off the inner condyle, by a double blunt hook, and protected from the saw, the lateral ligament severed, the elbow forcibly bent, so as to turn out the ends of the bones. The olecranon may now be cut off with the saw or forceps, when it will be clearly seen what other portions of bone are diseased. The end of the humerus, as well as the head of the humerus may now be removed. Enough bone must be removed to prevent ankylosis. As much as the brachialis anticeps must be removed from the coronoid process as may be necessary; the triceps tendon must be left as long as possible.

When the bleeding has ceased, the wound is to be brought together by sutures, dressed antiseptically, and the arm in a half-bent posture, laid upon a well-padded angular splint, and secured by bandages.

When the reparative stage has fairly set in, the arm is to be moved from time to time, so as to form a *false joint.*

There are many varieties in the plan and shape of the incisions; the most practical is to make the incisions connect and fall into the tract of any sinuses that may exist. In short and muscular men the H incision is the best, especially if there be much enlargement of the joint.

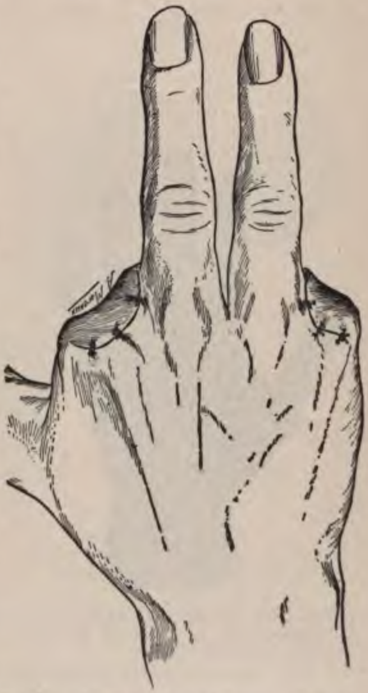


Fig. 103.—Finger Amputations. (*Veau.*)

EXCISION OF THE WRIST JOINT.

The incisions and modes of procedure in this operation vary in each case according to the situation and extent of the disease; no precise rules can, therefore, be laid down.

The form of the incision must be guided by the presence of the sinuses on the surface; by following these a sufficient opening may be usually made between the extensor tendons and the bones.

One of the most usual modes of operating consists of longitudinal incisions on both sides of the wrist joint, or incisions on the dorsal and internal lateral aspects, directed so as to go between the tendons without dividing them. An incision to the ulnar side of and parallel to the tendon of the *extensor secundi internodii pollicis,* and another vertical on the inner side of the joint, between it and the *flexor carpi ulnaris,* will give sufficient room to remove the diseased carpal and bases of the metacarpal bones.

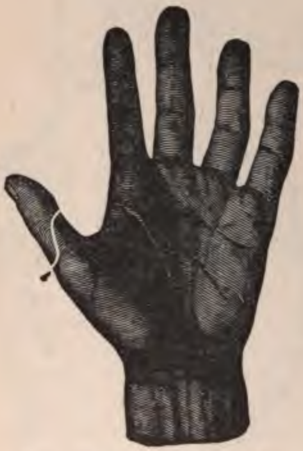


FIG. 104.—Line of Incision for Amputation of Phalanx of Thumb. (*Veau.*)

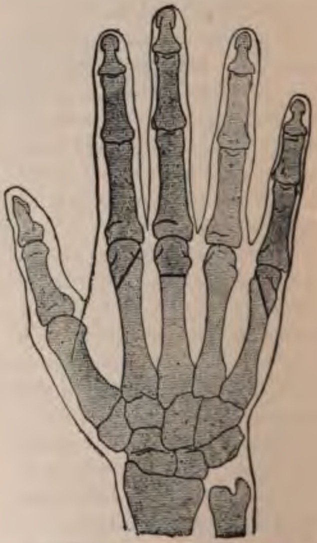


FIG. 105.—Bone Incisions in Finger Amputations. (*Veau.*)

EXCISION OF THE HIP JOINT.

To perform this operation, make a long, straight incision down the outer side of the limb, beginning below and behind the anterior superior he ilium, and passing over the great trochanter. The attachment of the muscles having been severed from the trochanter, the bone is turned out of the wound by raising, and adducting it at the knee; the neck and head of the bone, if necessary, to be dissected out of the acetabulum.

Another method of performing this operation is to make a semicircular incision, beginning just above the edge of the *tensor vaginæ femoris*, and curving downward and outward, so as to cross the bone an inch below the trochanter, from whence it should turn a little upward. This flap, including skin, fascia lata, *tensor vaginæ femoris* and part of the *gluteus maximus*, should be turned up, the muscles attached to the injured parts divided, and complete the remaining steps of the operation as above.

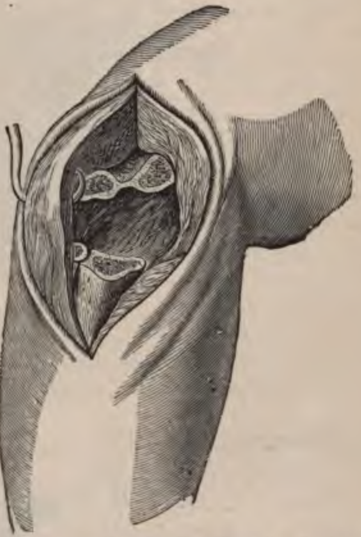


FIG. 106.—Section of the Bones in Excision of the Elbow Joint. (*Moullin.*)

EXCISION OF THE KNEE JOINT.

Make a semicircular incision, with the convexity downward, commencing at the side of one condyle of the femur and passing immediately above the tubercle of the tibia, to a corresponding point on the opposite condyle. This incision divides the ligamentum patellæ, and the patella is turned up in the flap; the crucial ligaments are then to be cut across, and any remaining lateral attachments divided. The limb must now be forcibly flexed, and the knife carefully applied to the posterior part of the head of the tibia; a blunt-pointed resection knife is best for this purpose. Saw off the articular surfaces. The lower end of the thigh-bone should first be removed; it must be made accurately at right angles to the shaft of the femur in the antero-posterior direction.

A thin slice is next taken off the tibia; the section must be accurately at right angles to the shaft of the tibia.

Care must be taken not to remove more of the bones than is absolutely necessary, especially in young subjects.

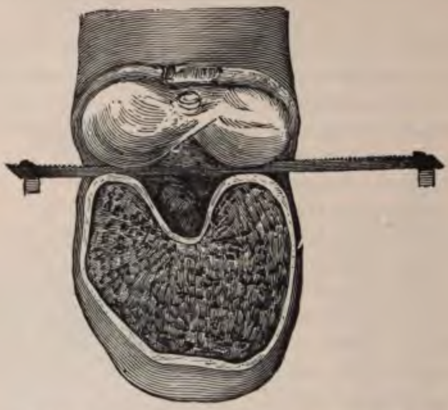


FIG. 107.—Excision of Knee Joint, Removal of Head of Tibia.

If the patella be much diseased, it must be removed; if it be only slightly carious it may be scraped or gouged out; if healthy, it should be left to consolidate and strengthen the joint.

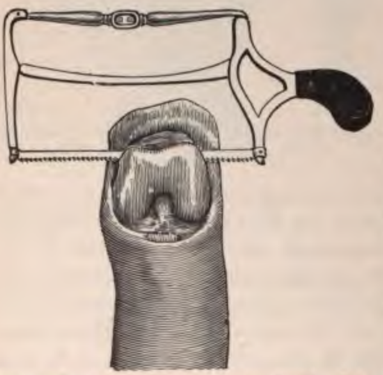


FIG. 108.—Excision of Knee Joint, Removal of Head of Femur.

To keep the bones in position, they should be drilled obliquely at the anterior part, and secured by a couple of strong sutures of kangaroo tendon or silver wire. If the wound be not aseptic, wire sutures are the best. Before the wound is closed, all hemorrhage must be thoroughly arrested. Ligatures must be applied to the articular arteries, if necessary. The limb must be kept at perfect rest for the first few weeks; a narrow, properly-padded splint, extending from the hip to the heel, will *answer* all indications. It should be fixed in a position by a flannel bandage above and below the knee, over which a firm plaster-of-Paris bandage must be applied.

EXCISION OF THE ANKLE JOINT.

Place the foot on its inner side, and make an incision along the posterior face of the fibula, beginning three inches above its lower extremity, and after reaching the end of the malleolus, change its direction, and terminate about half an inch short of the metatarsal bone of the little toe. Raise the flap and reflect it forward, exposing the surface of the fibula, taking care not to injure the tendons of the peroneus longus and brevis muscles, which lie against the posterior and outer surface of the bone. The fibula is now to be cut through with strong bone-pliers, and its lower extremity dissected out.

Should the disease be found to be very limited and accessible, the one incision here recommended will suffice; if the disease is more extended, the foot must be placed on its outer surface, and a second incision must be made along the inner angle of the tibia and terminating at the internal cuneiform bone. Dissect back the flap, keeping close to the bone, so that the tendons of the *tibialis posticus, flexor longus digitorum,* and the posterior tibial artery, veins and nerves, may be raised without injury. Hold these parts aside, and cut away the internal malleolus with the bone-pliers, and divide the internal lateral ligament.

Clear the bone in front and behind with the handle of the scalpel, and strongly evert the foot, when the tibia and upper surface of the astragalus will be exposed at the internal wound.

The bone can now be divided from behind forward, by a narrow-bladed saw being passed through the internal wound, behind the tibia, and made to appear at the external opening. The upper surface of the astragalus may be now sawn off.

The wound must be thoroughly washed out with bichloride solution, a drainage tube passed through from one side of the joint to the other, the sides of the incision closed by interrupted sutures, and the whole dressed antiseptically.

The foot and leg must be covered with a bandage and plaster rollers applied, care being taken to give the foot a proper angle with the leg, the foot being held by the hand of an assistant until the plaster is hardened. Traps are to be cut on the sides of the splint opposite the wounds.

WHEN EXCISION IS ADMISSIBLE.

Erichsen, in his work on the "Science and Art of Surgery," lays down the following general rules for the performance of resections of joints in cases in which it is admissible:

1. As a substitute for amputation in cases in which the joint is so extensively diseased that the patient will be worn out by the discharge or pain, unless it be removed.
2. In some cases of articular disease in which amputation would not be justifiable, excision may be done in order to hasten the cure, and this saves years of suffering to the patient.
3. Excision may be done in cases in which *amputation is not practicable,* as in some cases of disease of the hip joint, or of the temporo-maxillary articulation.
4. As a substitute for other and less efficient treatment; in order to *restore the utility of a limb to a joint;* as in osseous ankylosis of the elbow, or in faulty ankylosis of the knee.
5. Excision may be required, in bad compound dislocations and fractures into joints, especially in *gunshot* injuries, more particularly in those of the head of the humerus, and of the bones entering into the elbow joint.

As a general rule excisions are required only in those cases in which the articular ends of the bones are diseased either primarily or secondarily.

Conditions of Success.—For resection to succeed, the following conditions appear to be necessary:

1. The disease should not be too extensive, so that its removal would entail such an amount of mutilation of the limb as to render it less useful to the patient than an artificial member would be. This is especially important in the lower extremity.
2. The disease that resection is practiced for should be allowed to become chronic before any operation is undertaken.
3. The soft parts about the joints must be in a sufficiently healthy state.
4. The state of the patient's constitution must necessarily influence the surgeon materially in his determination, whether to resect or to amputate.
5. The extremes of life are unfavorable to resections.

LIGATION OF ARTERIES.

General Considerations.—Arteries are ligated in their continuity to eradicate aneurysms, to arrest hemorrhages, and to control acute inflammations.

When operating the greatest caution must be exercised to prevent the wound becoming infected, causing sloughing to ensue, when septicemia or pyemia may result, terminating in secondary hemorrhage.

When about to ligate an artery the operator must be careful to first establish its true course, which may often be determined by a line drawn to connect two anatomical points, which when ascertained will lie over the track of the vessel. This line is of service as indicating where the incision in the skin should be made, which must always be at an angle of five degrees to the line of the artery. The length of the cut varies with the location of the vessel, its size, and its depth from the surface.

Precise directions as to the proper length of the incision will be given in each case when describing especial operations.

It is a good rule to allow too much rather than too little room when making the external incision. After the skin has been divided, the fascia is to be taken up on a grooved director and divided to the length of the wound made in the skin. With but few exceptions the muscles should be separated one from the other by means of the handle of the scalpel; when the sheath of the artery is reached it is to be gently picked up by a pair of dissecting forceps; the forceps should be *lateralized* in order to lift the sheath from the vessel; which should then be very carefully nicked and torn through with an Allis dry dissector. The opening should be made no larger than is sufficient to

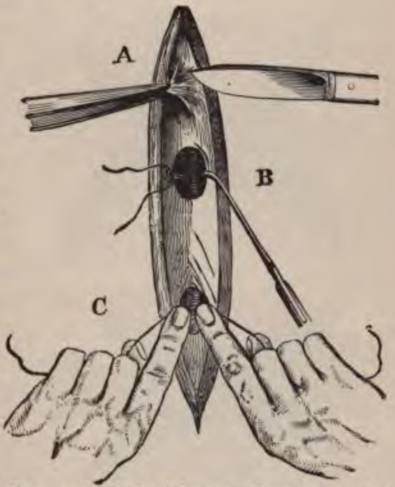


FIG. 109.—This Diagram Represents three Distinct Operations. *A*, Opening the Sheath; *B*, Drawing Ligature Around Artery; *C*, Tying Artery. (*Bryant*.)

allow the aneurysm needle to pass freely around the artery. The vessel must then be very carefully separated from its surrounding structures, and the armed aneurysm needle carried around the artery, passing it away from, rather than toward the vein or nerve, should there be an accompanying vein or nerve; the needle is then withdrawn, leaving the ligature behind, which is tied, the ends cut off, and the wound closed in the usual way.

The points that assist the operator in finding the artery are its *line*, its *guiding muscle*, and its *pulsation*.

The *guiding muscle* is recognized, when by using either flexion and extension, or pronation and supination, the muscle is caused to "spring," as it is technically called.

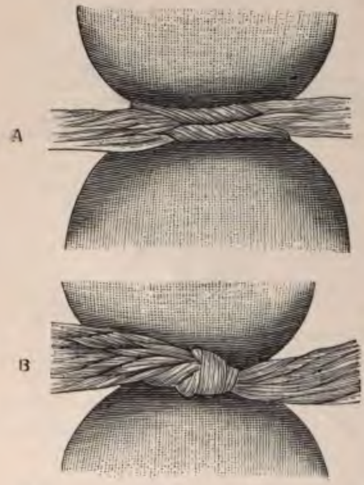


FIG. 110.—The "Stay Knot" of floss silk. *A*, First Stage; *B*, Completed. (*Ballance and Edmonds.*)

The artery must be tied as far as possible from the nearest branch, as the clot that is formed never extends beyond the nearest point of junction, and it may thus be found too short to plug the artery, and liability to dangerous hemorrhage would ensue when the vessel is finally severed by the ligature.

Ligatures are made of chromicized or ordinary catgut, twisted silk, and floss silk.

The knots employed are the surgeon's knot for vessels of small or medium size, and the stay knot of Ballance and Edmunds for arteries of larger calibre. This knot consists of two or more ligatures applied side by side. On each one of them an ordinary single knot with two turns is made and the ends laid down. A similar knot is then tied on the other ligatures. The ends of both ligatures are then taken together and drawn upon equally, and the second knots tied as though they were but one thread. If there are multiple ligatures they are tied in pairs. The two ends are fastened together and the ends are cut off short. The intima is thus brought in apposition without rupturing the internal and middle coats.

When the main artery of a limb is ligated, the extremity should be wrapped in cotton, after dressing the wound aseptically, and kept at absolute rest. Splints should be employed if necessary.

The instruments needed for these operations are: scalpel, grooved director, retractor, aneurysm needle, scissors, dissecting forceps, and hemostatic forceps.

LIGATION OF SPECIAL ARTERIES.

THE FACIAL ARTERY.

This artery may be readily tied by cutting through the skin, platysma, myoides muscle, and fascia at the point where it turns over the jaw at the anterior border of the masseter; for this purpose an incision one inch in length in the line of the artery is made, and the superficial fascia and fibres of the platysma divided on the director, when the artery and vein outside will be exposed to view.

But this operation can hardly ever be necessary, as a small harelip pin may be easily passed under it without an incision and a twisted silk suture passed over it.

THE OCCIPITAL ARTERY.

This is the first branch of the external carotid artery arising from the posterior part; it passes backward beneath the posterior belly of the digastricus, the trachelo-mastoid, and sterno-mastoid muscles to the occipital groove in the mastoid portion of the temporal bone.

Divide the skin one and a half inches in length over the course of the artery from the mastoid process of the temporal bone to the external occipital protuberance. The artery will be exposed when the fascia, aponeurosis of the sterno-mastoid muscle, and the splenius capitis muscle have been divided. The vein lies on the outside, and must be avoided when the ligature is applied.

TRIANGLES OF THE NECK.

Before attempting to ligate the arteries of the neck the student should thoroughly master the triangles. A synopsis of these, with their contents, is here presented:

The great anterior triangle is bounded above by the body of the lower jaw, in front by the middle line of the neck, and behind by the sterno-mastoid muscle. It is subdivided into three minor triangles—

1. **The submaxillary traingle,** formed by the two bellies of the digastricus muscle and the inferior border of the lower jaw. *The submaxillary gland* is situated in the posterior angle of the submaxillary triangle. It is separated from the parotid gland by the stylo-maxillary ligament, and from the sublingual by the mylo-hyoideus muscle. Imbedded among its lobules is the facial artery.

2. **The superior carotid triangle** is formed by the posterior belly of the digastric muscle, the upper belly of the omo-hyoid, and the sterno-cleidomastoid. This triangle contains the upper portion of the common carotid artery and its bifurcations into the external and internal carotids; the superior thyroid, and the commencement of the lingual arteries; the internal jugular vein, and a chain of lymphatic glands; the descendens noni nerve in front of the sheath of the carotid, the pneumogastric within and the superior laryngeal and sympathetic behind. The lingual nerve crosses the upper angle.

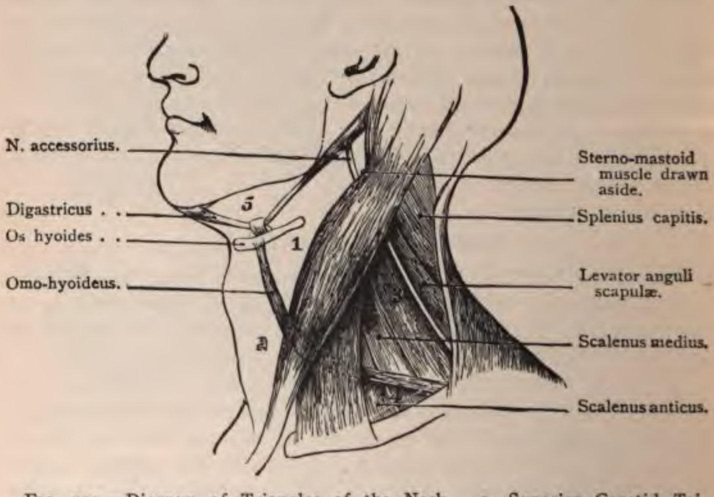


FIG. 111.—Diagram of Triangles of the Neck. 1, Superior Carotid Triangle; 2, Inferior Carotid Triangle; 3, Occipital Triangle; 4, Supra-clavicular Triangle; 5, Submaxillary Triangle.

3. **The inferior carotid triangle** is bounded by the superior belly of the omo-hyoid muscle, the sterno-mastoid muscle, and the middle line of the neck. In this triangle is found the lower part of the common

carotid artery and jugular vein, descendens noni, pneumogastric and sympathetic nerves, and recurrent laryngeal nerve.

The great posterior triangle is bounded in front by the sterno-mastoid, behind by the border of the trapezius muscle, and below by the clavicle. It is subdivided into two minor triangles by the inferior belly of the omo-hyoid muscle: (1) the *suboccipital* and (2) the *subclavian* triangles.

1. **The suboccipital triangle** is situated above the omo-hyoid, and contains the suboccipital nerve at its upper angle and the spinal accessory nerve and branches of the cervical plexus below.

2. **The subclavian triangle** is bounded in front by the sterno-mastoid, behind by the inferior belly of the omo-hyoid, and below by the clavicle.

The subclavian triangle contains the termination of the external jugular vein, the third part of the course of the subclavian artery, and the brachial plexus of nerves, and is crossed by the posterior scapular artery.

THE LINGUAL ARTERY.

This artery is usually tied in the triangle bounded by the anterior and the posterior belly of the digastricus, and by the inferior border of the lower jaw. At this place it is covered by the skin, platysma, cervical fascia, submaxillary gland, and the hyoglossus muscle.

The guides are the hypoglossal nerve above the vessel, the anterior border of the digastric tendon and the great horn of the hyoid bone below the artery.

To perform this operation the head is drawn over to the opposite side; a curved incision is made, two-thirds of an inch above the junction of the greater cornu with the hyoid bone, and parallel with it, as far as the median line of the neck. Divide the skin, platysma, and cervical fascia, and draw the posterior facial vein outward. Raise the submaxillary gland and look for the posterior belly of the digastricus; passing downward and forward to its attachments to the hyoid bone, the posterior border of the mylo-hyoid; and the hypoglossal nerve behind and below the digastric, accompanied by the lingual vein lying in front of the hyoglossus. Draw the hyoid bone slightly downward, with a blunt hook fixed in the lower angle of the triangle, and then divide the fibers of the hyoglossus along a line parallel with the nerve and midway between it and the bone. The artery will then be in sight and can be easily tied. This artery has been tied in wounds and operations upon the tongue, but considering the depth at which it lies from the surface, it is considered better to tie the external or common carotid. The artery may be compressed by passing the finger down to the epiglottis and hooking it outwards under the angle of the jaw (Walsham).

THE COMMON CAROTID ARTERY

on each side lies upon the *longus colli* muscle, and is contained in a dense areolar sheath, which also includes the internal jugular vein on its outer side and the pneumogastric nerve between; in front of the sheath is the *descendens noni* nerve; behind the sheath lie the sympathetic and cardiac nerves. At the lower part, the inferior thyroid artery and recurrent laryngeal nerve cross behind it toward the larynx. The line of the artery is from the sterno-clavicular articulation to a point midway between the angle of the lower jaw and the tip of the mastoid process. The artery bifurcates on a level with the top of the thyroid cartilage, except in long-necked women, when it usually is found somewhat below this point.

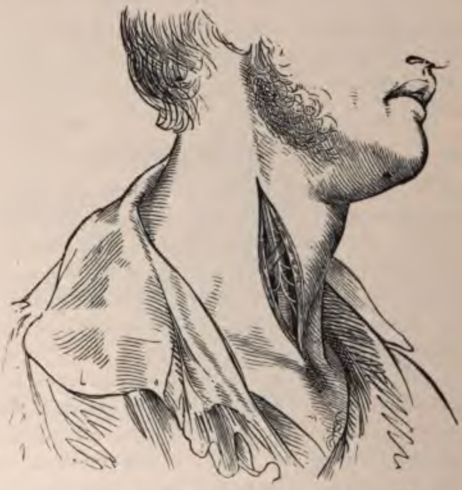


FIG. 112.—Relations of Common Carotid.

The left common carotid arises from the arch of the aorta, and rests first on the side of the trachea, esophagus, and thoracic duct; the left jugular vein lies rather in front of the carotid, as it joins the left brachio-cephalic vein.

The right carotid arises from the *arteria innominata,* behind the sterno-clavicular articulation, and ascends more perpendicularly. Both arteries divide into internal and external carotids opposite the upper border of the thyroid cartilage in the male, and in the middle of the thyroid cartilage in the female.

At the lower two-thirds each artery is covered by the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and is crossed by the omo-hyoid, opposite the cricoid cartilage. At the upper part of its course the artery is covered only with skin, fascia, and sheath; upon the last lies the *descendens noni* nerve.

To tie the common carotid in its lower part in the inferior carotid triangle the patient must be placed on his back, with shoulders raised, head thrown back and slightly turned toward the opposite side; an incision three inches in length is made on the line of the artery, the inner margin of the sterno-mastoid muscle being the guide; this incision should extend from opposite the thyroid cartilage to the sternum, and must be carried through skin, platysma, and superficial fascia. The sterno-mastoid must now be relaxed by turning the head to the side operated on; now expose the edge of the sterno-mastoid, and look for and avoid the external jugular vein; separate and draw outward the sterno-mastoid, and draw inward the sterno-hyoid and sterno-thyroid muscles. Scratch through the dense fascia which unites the omo-hyoid in the sheath, when the latter will be seen with the branches of the *descendens noni* upon it; this must be drawn aside. The sheath must be pinched up with the forceps and opened with a careful touch of the knife, its flat surface toward the artery. Enlarge the aperture on a director, detach the artery from its connections for a limited extent, with a probe and an aneurism needle, which, armed with a double ligature, is passed around the vessel from without inward; avoid the vagus nerve, by keeping the point of the needle close to the vessel. When the point appears on the inner side seize the ligatures with the forceps, and withdraw the needle; ascertain that the nerve is not included in the ligatures, and tie them with the stay knot.

To tie the common carotid in its upper part in the superior carotid triangle, the patient is placed on his back, head thrown back; an incision three inches long is made through the skin and platysma, on the anterior edge of the sterno-mastoid muscle, from a little below the corner of the lower jaw to opposite the cricoid cartilage. The deep fascia is now pinched up, opened, and carefully divided; the edges of the wound are then to be drawn asunder; next feel for the pulsation of the artery; open the sheath over it, care being taken to get on the inner or artery side of the septum, between the artery and vein; do not include the *descendens noni* in front of the vagus and sympathetic nerve behind. Expose but a small portion of the artery, and pass the aneurism needle from without inward.

THE EXTERNAL CAROTID ARTERY.

Owing to its numerous branches and anatomical complications, except when wounded, this artery is seldom ligated. It may be tied either near its point of origin or above the posterior belly of the *digastric muscle.*

Ligation Near the Point of Origin.—The line is the same as that given for tying the common carotid. The shoulder should be raised and the head turned to the opposite side. An incision three inches in length should be made downward opposite the greater cornu of the hyoid bone, on the line of the vessel and along the anterior border of the sterno-cleido-mastoid muscle; then carefully divide, on the director, the platysma, superficial and deep fascia in turn, when the sheath of the vessel will be brought into view; seize this with a pair of dissecting forceps, lateralized, and open the sheath with the back of the knife, laying bare the artery. The aneurysm needle is then passed from without inward, great care being taken to avoid the internal carotid artery, which lies external and behind.

Ligation Above the Posterior Belly of the Digastric Muscle.—An incision is made from the lobe of the ear to the junction of the greater cornu with the hyoid bone. The same structures are divided and in the same manner as when ligating the vessel near its point of origin, but in cutting down on the sheath numerous veins that will be found in the path of the surgeon may require the protection of a double ligature before proceeding with the operation; necessarily some will be wounded; when this occurs they must be at once caught with the hemostatic forceps and secured by ligature. At the bottom of the wound will be found the posterior belly of the digastricus, together with the stylo-hyoid muscle; these are to be separated from the parotid gland, which is above, when the artery will be found just before it enters that structure, and can be easily tied.

ARTERIA INNOMINATA.

The patient is to be placed on his back, with shoulders raised and head thrown back; an incision two and a half inches in length is to be made along the inner margin of the sterno-mastoid, terminating at the clavicle, and another across the origin of that muscle, meeting the former at an angle; the flap thus formed is to be turned up, and the sterno-mastoid divided at the sternal and part of the clavicular origin. Turn aside the areolar tissue and fat, and divide the sterno-hyoid and thyroid muscles. Scratch through the strong fascia, which is next presented, very cautiously; then trace the carotid carefully, with the finger, to its origin. The vena innominata must then be held down with a spatula, and a ligature, carried *from without inward*, must be brought around the artery, close to its bifurcation, care being taken to avoid the vagus, recurrent and cardiac nerves, and pleura.

THE SUBCLAVIAN ARTERY.

The ligation of the first and second parts of the artery is rarely performed. In the *third part* of its course it is about one and a quarter inches long, and passes from the outer border of the *scalenus anticus*, downward and outward, under the clavicle, to the lower border of the first rib, where it becomes the axillary. To locate the artery at this portion, divide the clavicle into thirds; under the center of the middle third it will be found.

Ligation of the Third Part.—The patient must be laid on a table, with the shoulder of the affected side drawn downward and forward, and the head turned to the other side. An incision from three to four inches long is then made, half an inch above and parallel with the clavicle. In order to avoid the external jugular vein draw the skin down over the clavicle. An incision is then made directly upon the upper margin of the clavicle down to the bone, extending from the outer margin of the sterno-cleido-mastoid muscle to the inner border of the trapezius muscle. By drawing the integument well down over the clavicle, the external jugular vein is retracted underneath the clavicle, thus escaping injury. When all the tissues are divided to the bone the integument is allowed to assume its normal position, and the line of the incision will be found to be about one half inch above the clavicle, and directly over the course of the artery. It must cut through the skin and platysma, and extend from the outer edge of the sterno-mastoid to the trapezius. The external jugular, now exposed, must be drawn aside with a blunt hook; it is generally more convenient to draw it to the inner side, or it may become necessary to ligate and cut it. The clavicular portion of the sterno-mastoid must be divided. The fascia must now be carefully divided, tearing it with the forceps if possible. The omo-hyoid is to be drawn up.

The anterior scalenus having been traced to its insertion in the rib, the pulsations of the artery will then be felt by turning the pulp of the finger outward, when the surrounding areolar tissue must be carefully torn through. Care must be taken to avoid the lower trunks of the brachial plexus of nerves, which may appear first; the cessation of the pulse at the wrist, when the trunk is pressed by the finger, is good evidence that it is the sought-for vessel, and not a nerve. Venous hemorrhage, if troublesome, and cannot be controlled by pressure, must be stopped by tying the veins.

The ligature must be carefully passed *from below upward.*

THE AXILLARY ARTERY

extends from the lower border of the first rib to the lower end of the *teres major,* in the axilla; surgically it is divided by the pectoralis minor into three parts; the first part extends from the lower border of the first rib to the posterior border of the pectoralis minor, the second lies under the muscle, and the third extends from the anterior border of the pectoralis minor to the teres major.

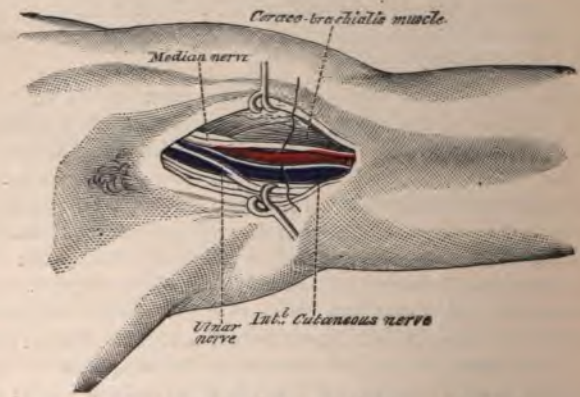


FIG. 113.—Ligature of Axillary Artery. (*Moullin.*)

To tie the artery in the first part, below the clavicle, the shoulder and arm must be drawn back, so as to form an angle of 80°, and put the pectoral muscles on the stretch; an incision, four inches long, is then to be made from the coracoid process inward, in a transverse depending curve, half an inch below the clavicle. The clavicular fibers of the *pectoralis major* are then to be divided to the same extent; the lower border of the wound is then to be drawn downward, the costo-coracoid membrane cut through, when the edge of the *pectoralis minor* will be readily seen, crossing upward and outward over the vessels and nerves. Wounded branches of arteries should at once be tied.

To relax the *pectoralis major,* the arm should now be brought to the side; a few scratches with a director will expose the axillary vein, which should be held inward. Then seek for the beating of the artery, which must be carefully isolated, and an aneuryism needle passed from without inward.

The nerves lie on the outside and behind, and care must be taken not to include them with the artery.

To tie the axillary artery in the third part, that is, in the armpit, the patient is placed on his back, the arm placed at right angles with the trunk, the forearm being flexed upon the arm. The axillary vessels and nerves lie between the *pectoralis major* in front and the *latissimus* and *teres major* behind, and can be readily felt against the upper end of the humerus, the *coraco-brachialis* and biceps being placed externally, and are the guides to the vessel. To locate the vessel at the point where the ligation is to be performed, draw a line from the great pectoral to the latissimus dorsi; divide it into thirds; the vessel will be found at the junction of the anterior and middle third.

The operator makes an incision, two and a half inches long, parallel with the end of the humerus, on the line of the artery; he then dissects carefully through the fascia, until the basilic, axillary vein, and median nerve are revealed; the veins are to be drawn inward and the nerve outward, the artery being found between them, and is exposed by tearing with the forceps and director. Care is to be taken not to wound the thoracic and subscapular veins. The aneurysm needle is passed between the vein and artery.

THE BRACHIAL ARTERY

passes obliquely down the inner side of the humerus to the middle of the bend of the elbow; it runs along the inner borders of the *coraco-brachialis and biceps*, which form the guides to it. It is accompanied by two *venæ comites* and is encircled by their numerous branches; it is likewise accompanied by the *median nerve,* which first lies on its outer side, between it and the *coraco-brachialis;* then crosses over it, and is quite internal to it at the elbow. A line drawn from the junction of the anterior and middle third of the "axillary line" (*i. e.,* from the great pectoral to the latissimus dorsi), to a point midway between the condyles of the humerus, indicates the course of the artery.

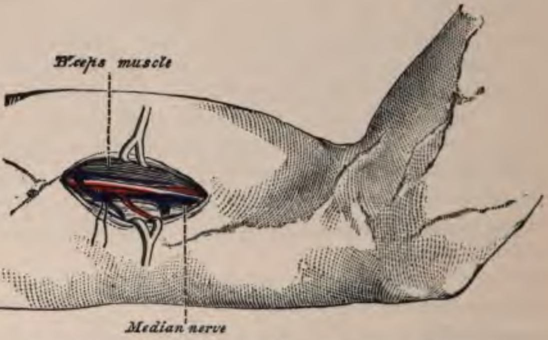


FIG. 114.—Ligature of Brachial Artery. (*Moullin.*)

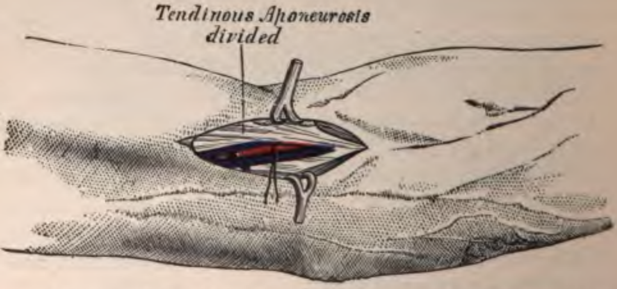


FIG. 115.—Ligature of Brachial Artery at the Bend of the Elbow. (*Moullin.*)

To tie the brachial at its upper third, the limb must be drawn from the side and supinated. The operator identifies the *coraco-brachialis,* and feels the pulsation of the artery; he then makes an incision, three inches in length, over the artery, opposite the middle of the *coraco-*

brachialis; divides the fascia to the same extent; the basilic vein will probably be found to the inner side of the artery. The forearm may now be bent, to relax the parts, and the muscles, if in the way, must be drawn aside, the sheath of the artery opened, and the median nerve drawn aside. Having identified the artery, by its pulsation or the appearance of its coats, the needle must be passed in whatever direction the operator finds most convenient.

To tie the brachial artery in the middle of the arm, the incision is to be made along the inner side of the biceps, at the *insertion* of the *coraco-brachialis* muscle. The median nerve usually lies over the vessel, and must be drawn aside; the biceps being well relaxed, the needle should be passed from within outward.

To tie the brachial artery in its lower third, an incision, from two and a half to three inches long, should be made obliquely, about half an inch internal to the tendon of the *biceps,* first ascertaining its position; and the median basilic vein, if in the way, must be held aside, passing the ligature needle *from the median nerve.*

THE RADIAL ARTERY.

This artery may be tied in any part of its course.

Ligation in the Upper Third.—The "line" of the artery is from the middle of the bend of the elbow to the ulnar side of the styloid process of the radius. The nerve lies to the radial side of the artery.

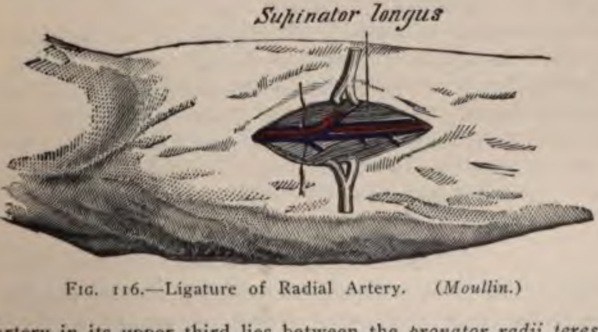


FIG. 116.—Ligature of Radial Artery. (*Moullin.*)

The artery in its upper third lies between the *pronator radii teres* and the *supinator longus,* and is overlapped by the last named muscle; it is accompanied by the *venæ comites.*

To tie the artery the forearm must be held in the supine position;

an incision from two and a half to three inches long must be made over its course at an angle of five degrees to the line of the vessel, and in the direction *from without inward*. The skin, superficial and deep fascias being divided, the muscles are turned aside with the handle of the knife, and the artery having been separated from the *vena comites*, the ligature needle is passed around it from without inward.

In the middle third the same line is used and same length of incision is made as in the upper third. The artery lies between the *supinator longus* and the *flexor carpi radialis* muscles, which are separated as already directed, when the vessel is tied.

In the lower third the artery lies between the same muscles as the middle third, and the mode of ligation is precisely similar, except that the operation is performed nearer the wrist.

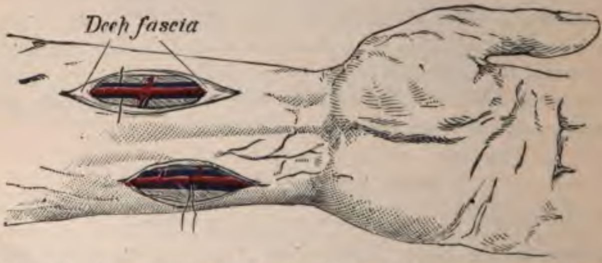


FIG. 117.—Ligature of the Radial and Ulnar Arteries. (*Moullin.*)

To tie the radial artery on the outer side of the wrist, over the "snuff box," an incision is to be made through the skin, from opposite the styloid process of the radius to the commencement of the first interosseous space. The guide to the artery is the *extensor secundi internodii pollicis*, which crosses the artery before it dips into the palm. The incision should be two inches long. The ligature is to be applied on the ulnar side of the tendon.

THE ULNAR ARTERY.

As a rule, this artery is only tied in its upper third for wounds. The course of the vessel is oblique from without inward.

To Tie the Artery in the Upper Third.—The "line" of the vessel is from the middle of the bend of the elbow to the junction of the upper and middle third of the shaft of the ulnar. An incision should be made at a point two and a half inches below the internal condyle of the humerus, and one-third the width of the arm from the inner edge, extending downward about three inches; divide the skin and fascia, find the septum of the *flexor carpi ulnaris* on the inside, and the *flexor sublimis digitorum* on the outside. Incise the septum, separate the superficial muscles from the *flexor profundis digitorum;* the artery will be found lying on this muscle. The ulnar nerve should be looked for as a guide to the artery; *the needle should be passed from the nerve.*

To Tie the Artery in the Middle.—A line drawn from the internal condyle of the humerus to the radial side of the pisiform bone covers the ulnar artery. The artery will be found between the *flexor carpi ulnaris* and *flexor sublimis digitorum.*

To tie the artery in the lower third, or above the wrist, an incision two inches long is required on the same line as that given for reaching the vessel at its middle portion. The incision should be made three-quarters of an inch from the ulnar edge of the limb and just external to the flexor carpi ulnaris. After the skin and fascia have been divided, the artery will be found covered by the tendon of the flexor carpi ulnaris, which is internal, and the flexor sublimis digitorum, which is external.

The venæ comites having been separated, the needle is passed *from the nerve,* which lies on the ulnar side of the artery.

THE COMMON ILIAC ARTERY.

To tie this artery, make a slightly curved incision, six inches in length, the lower third being about two inches above Poupart's ligament, and parallel with it. Divide the muscles and tear through the transversalis fascia; gently repress the intestines upward, which will protrude through the wound, and separate the peritoneum from the iliac fossa. When the brim of the pelvis is reached, seek the external iliac, which is a guide to the common trunk. Open the sheath just above the bifurcation and, if possible, pass the needle from within outward.

THE EXTERNAL ILIAC ARTERY

lies on the inner border of the psoas muscle, the vein being on the inner side and elbow. The genital branch of the *genito-crural* nerve lies on it for a short distance. The artery is invested by the peritoneum, and high up is crossed by the sigmoid flexure of the colon on the left side, and by the ilium on the right side; the ureter is near its division. Low down it is crossed by the spermatic cord in the male and the round ligament in the female, and is crossed by the *circumflex iliac* vein.

To tie the external iliac the patient must be placed flat on a table, so that the abdominal muscles may be rendered tense. Make an incision, three and a half or four inches long, above and parallel to Poupart's ligament, beginning about half an inch outside the external abdominal ring; carry it through the skin and superficial fascia, and lay bare the external oblique tendon. Then cut through this tendon, the *internal oblique,* and *transversalis muscles* to the extent of the incision. A portion of the muscular fibers should be lifted with the forceps and carefully cut through, to form an opening, into which a broad, flat, grooved director must be insinuated, and the muscle divided upon it to the necessary extent. Now gently draw the edges of the wound asunder with bent spatulæ; the opening must be enlarged by tearing with the fingers. Then carefully strip the peritoneum off from the iliac fossa until the finger reaches the artery. The sheath must be scratched through with forceps and director at the point selected, and the artery separated from the vein, which will be found *on the inner side;* the aneurism needle is then passed between them, excluding the *genito-crural*

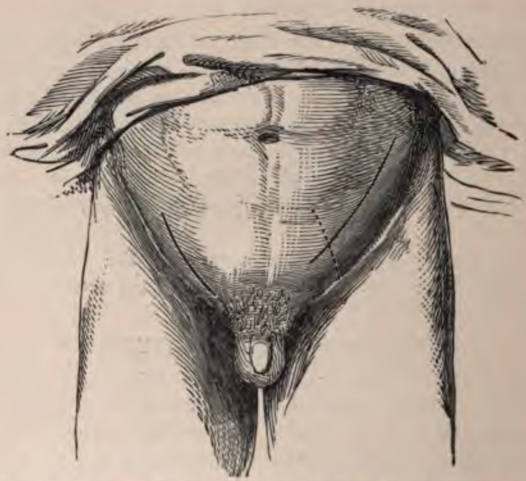


FIG. 118.—Lines of Incision for Ligation of External, Common and Internal Iliac Arteries.

nerve. The wound must be brought together by sutures, and the trunk bent forward, to relax the muscles.

THE SCIATIC ARTERY.

To tie the sciatic artery the patient must be placed on his face, with his toes turned inward; make an incision four inches long, from two and a half inches below the posterior spinous process of the ilium, an inch from the *sacro-iliac* joint toward the great trochanter. The fibers

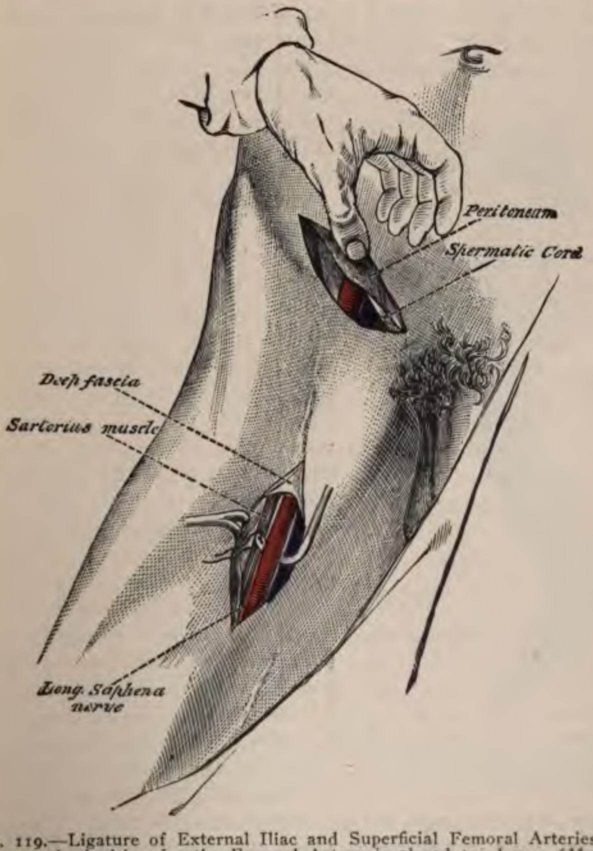


FIG. 119.—Ligature of External Iliac and Superficial Femoral Arteries. In this figure the incision for the Femoral Artery is placed too low. (Moullin.)

of the *gluteus maximus* must be separated for the same extent, and having arrived at the strong fascia, beneath the muscle, the vessel will be found emerging from the sciatic notch; the nerve and vein must be carefully avoided.

The gluteal-artery may be found by making the same incision, but one inch and a half higher up; be careful to avoid the nerve and vein.

These operations are exceedingly difficult, but are justified in the case of wounds.

THE FEMORAL ARTERY.

The course of the femoral artery is indicated by a line drawn from the middle of Poupart's ligament in the male, and a quarter of an inch toward the symphysis pubis in the female, to a point midway between the inner edge of the patella and the internal condyle of the femur, when the knee is bent and the thigh turned outward.

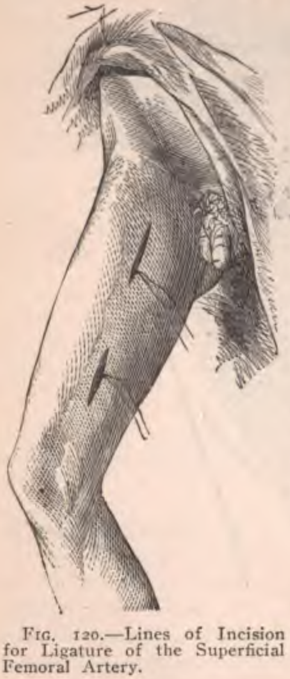


FIG. 120.—Lines of Incision for Ligature of the Superficial Femoral Artery.

The artery may be ligated at any portion of its course; the points of selection are the apex of Scarpa's triangle and in Hunter's canal. If possible the ligature should not be applied near the point of bifurcation, that is to say, where the common femoral divides into superficial femoral and profunda femoris. The reason has already been given. It is preferable to tie the external iliac rather than to ligate the artery near the bifurcation. If the vessel be wounded, it is to be secured at the point of injury, enlarging the wound in the tissues in order to reach the injured artery if necessary.

The vein lies to the inside of the artery under Poupart's ligament, behind it at the apex of Scarpa's triangle, and outside when in Hunter's canal.

To Tie the Artery at the Apex of Scarpa's Triangle.—The center of Scarpa's space is two and a half inches below Poupart's ligament, hence the apex is five inches below that point. Make an incision three and a half inches in length, the center of which should be five inches below Poupart's ligament; the superficial fascia should be divided on a director, the sartorius being relaxed by abducting the thigh; find the inner edge of the sartorius and draw it gently outward. Under the inner edge of this muscle the sheath of the artery will be found; it is to be cautiously opened, sufficiently so to admit the needle, great care being taken not to transfix the vein, which at the apex of Scarpa's triangle is underneath the artery; to avoid this use a blunt needle and pass it from the inner side. Tie the stay knot with a double ligature of floss silk.

To Tie the Femoral Artery in Hunter's Canal.—Hunter's canal is formed by the fascias of the *abductor longus* and *abductor magnus* muscles, extending downward and inward to unite with the tendinous origin of the vastus internus. It is bounded externally by the vastus internus, and internally by the abductor magnus and the abductor longus muscles; it is triangular in shape and from one and a half to two inches in length, and is situated at the junction of the middle and lower third of the thigh.

To tie the artery, flex the leg and abduct the thigh. Make an incision four inches in length, the center of which will be directly at the junction of the middle and lower third of the thigh, on the line laid down for tying the artery higher up. Divide in turn the skin, superficial fascia, and deep fascia; search for the outer border of the sartorius muscle, which must be separated and drawn inward, when the canal will be exposed.

The canal contains the artery, the vein to the outside, and the long saphenous nerve to the outside. The sheath is to be carefully opened, and the needle passed from without inward, great care being taken not to injure the vein or nerve.

THE POPLITEAL ARTERY.

The artery lies in a lozenge-shaped space, formed above and externally by the biceps and on the inner side by the semi-membranosus, semi-tendinosus, gracilis, and sartorius muscles, below by two heads of the gastrocnemius muscle. The artery passes through this space from the side toward the internal to the external condyle: as it crosses the joint it lies in close contact with the posterior ligament of the knee joint. Its depth from the surface and the numerous branches given off render it inexpedient to tie it at this point except in case of wound.

The points upon which to apply a ligature are either at the superior or inferior angle of the popliteal space. At the upper portion of the space the vein lies to the outer side of the artery; it crosses and lies immediately above it at the middle, and lies to the inner side of the vessel at the lower portion. Above the vein and separated from it by a mass of fat is the internal popliteal nerve; in the upper part of the space it is to the outside of the artery, which it crosses at its middle, and lies at the inner side at the lower portion; hence from without inward there is first the nerve, then the vein, and finally, at the very bottom of the space, the artery.

To tie the artery in the upper portion of the popliteal space, the patient is placed upon his face, with his knees straight and legs extended. An incision three inches in length is made along the semi-membranosus. The skin, superficial and deep fascia are carefully divided, employing the director, when the border of the semi-membranosus will be presented; draw it to one side and expose the nerve, which is to be carefully separated from the vein underneath by an Allis dry dissector; the vein is then carefully drawn to one side, when the artery will be found below, to the inner side. The needle is to be passed from without inward.

To tie the artery in the lower third, a three-inch incision is made in the middle line between the heads of the gastrocnemius, and the skin, superficial and deep fascias are divided, care being taken not to wound the external saphenous vein; the nerve first, then the vein, and finally the artery will be found *in situ,* as described in the ligation of the upper third. Flex the leg slightly, so as to relax the gastrocnemius, carefully separate the nerve and vein, and pass the aneurysm needle from without inward.

THE POSTERIOR TIBIAL ARTERY.

To tie the posterior tibial, the patient should lie on his back, with the limb lying on its outer side, the knee half bent, and the foot extended on a pillow. A line drawn from the middle of the popliteal space to a point just behind the inner edge of the internal malleolus indicates the course of this artery.

To tie the artery in the upper third, an incision four inches long, half on the upper and half on the middle third of the leg, and an inch from the inner edge of the tibia, should be made through the skin and superficial fascia. Avoid the *saphena* vein. Divide the deep fascia, expose the muscles, and draw aside the *gastrocnemius;* expose the *soleus*, which is to be divided with great care at right angles to the inner edge of the tibia and to the whole length of the wound. The muscular fibers are cut through until the operator recognizes the tendinous origin of the soleus, which is to be lifted up with the dissecting forceps, divided on a director, when the artery will be discovered lying under the tibia and on the tibialis posticus muscle. The two veins are in very close contact; the nerve is superficial to the artery, and frequently to the outer side. A good rule whereby to recollect its position is that the nerve lies between the artery and the table. Pass the ligature from without inward.

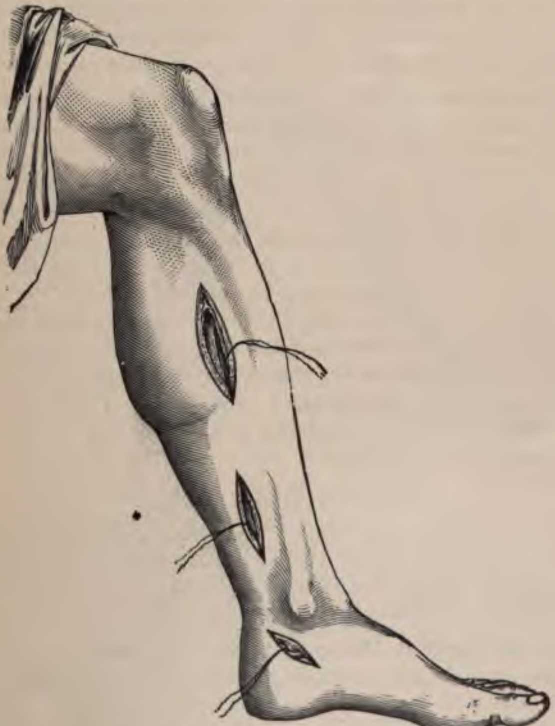


FIG. 121.—Tying the Posterior Tibial Artery.

To tie the posterior tibial in the middle of the leg, make an incision, three inches long, in the middle and lower third of the leg, half-way between the inner edge of the tibia and the inner border of the *tendo-Achillis*. Divide the fascia. The artery, surrounded with fat, accompanied by two veins, will be found along the inner edge of the *flexor longus digitorum;* the nerve is on the outer side. In the upper part of the leg, the posterior tibial nerve lies to the inner or tibial side of the artery; it passes over it about the middle, and inferiorly it lies to its outer or fibular side. Pass the ligature from without inward.

To tie the posterior tibial in the lower third, make an incision, three inches in length, on the line of the artery, dividing the skin, superficial and deep fascias; push outward the inner border of the tendo-Achillis, when the vessel will be found on the inner edge of that tendon; the nerve lies to the tibial side. Pass the ligature from without inward.

To tie the posterior tibial at the ankle, make a slightly curved incision, two and a half inches long, in the groove, half way between the hinder edge of the internal malleolus and the extremity of the heel, commencing near the tendo-Achillis; divide the superficial fascia, the dense fibers of the internal annular ligament, which adheres to the sheaths of tendons and covers the vessels and nerves, and the artery will be found with its venæ comites. The ligature is to be passed from below upward, avoiding the posterior tibial nerve.

ANTERIOR TIBIAL ARTERY.

This artery may be ligated in any part of its course. The line of the artery is indicated by taking a point midway between the head of the fibula and the crest of the tibia, dropping an inch, and from thence drawing a line to midway between the malleoli.

To tie the artery in the upper third, an incision three and a half inches in length is made through the skin on the line of the vessel; the superficial and deep fascias are then divided and the muscles exposed; the artery lies between the tibialis anticus and the extensor longus digitorum; the muscular space is to be sought for, and will be recognized by observing that it is the first from within outward; move the foot and four lesser toes, which will bring into action the muscles, which will guide to the artery. Separate the muscles with the handle of the knife and the artery will be seen on the interosseous membrane; the nerve, accompanied by venæ comites is on the outer side. Separate the veins from the artery and pass the ligature from without inward.

To tie the artery in the middle, make an incision three inches in length in the line of the artery, dividing the skin, superficial and deep fascias. The artery is usually found between the tendons of the extensor proprius pollicis and the extensor longus digitorum; if not found in this position look for it between the tendons of the tibialis anticus and the extensor proprius pollicis, as it is frequently in the last-named position. The artery here is quite superficial. Separate it from the venæ comites and pass the ligature from without inward.

To tie the artery in the lower third the incision should be three inches long on the line of the artery from the external border of the tibialis anticus muscle to the margin of the anterior annular ligament. The superficial and deep fascias should be divided on a director, and the artery sought for between the tendons of the tibialis anticus and the extensor proprius pollicis. If the artery be not found in this position, do not further interfere with the surrounding structures, but search between the tendons of the extensor proprius pollicis and the extensor longus digitorum, where the vessel will be discovered, with the nerve to the outside. Separate the artery from the venæ comites and pass the needle from without inward. It should be borne in mind that the vessel in this situation is superficial, therefore a deep dissection should not be made when looking for the artery.

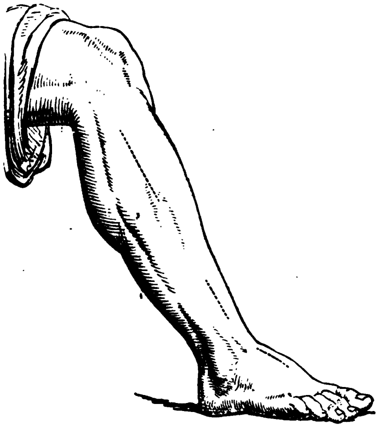


FIG. 122.—Lines of Incision for Ligature of the Anterior Tibial Artery.

THE PERONEAL ARTERY.

To tie this artery an incision four inches long is to be made, almost in the center of the leg, an inch behind the external edge of the fibula. Find the *soleus* and separate it from the peronei which encircle the outer side of the fibula; to expose the *flexor longus pollicis* it may be necessary to detach a portion of the peronei, the fibers of which must be separated longitudinally with the handle of the scalpel, and the artery should be found about the center, near the edge of the fibula. Bend the great toe so as to relax the *flexor longus pollicis* when it is exposed.

THE DORSAL ARTERY.

The course of the artery is indicated by a line drawn from the middle of the malleoli to the middle of the first interosseous space. The vessel lies very superficially, the incision, therefore, should *not extend below the upper point of the first interosseous space.*

The incision should be two inches in length, dividing the skin; the superficial and deep fascias should be divided on a director, when the artery will be found between the tendons of the extensor proprius pollicis on the inside and the inner border of the extensor brevis muscle on the outside. The nerve accompanies the artery on the outside. Separate the venæ comites and pass the needle from without inward.

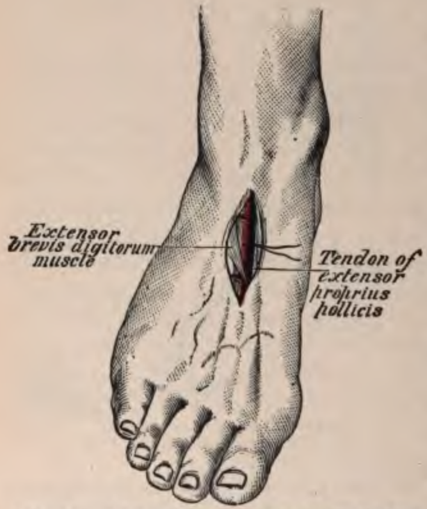

Extensor brevis digitorum muscle
Tendon of extensor proprius pollicis

FIG. 123.—Ligature of Dorsalis Pedis Artery. (*Moullin.*)

URINARY CALCULI.

Urinary calculi are found in four different situations in the urinary organs; in the kidney, ureter, bladder, and urethra.

A precipitate let fall from the urine after it has been voided is called a *sediment;* when precipitated in the bladder or kidneys it is called *gravel;* and gravel lodging in any part of the urinary passages may concrete into *stone.* When the urine habitually presents any one kind of deposit, the patient is said to have a corresponding *diathesis,* as the lithic diathesis, etc.

The lithic or uric acid, or red gravel, is deposited in the form of minute crystals, tinged with the coloring matter of the urine, the so-called lateritious brick dust deposit.

The *lithates of ammonia, soda* and *lime,* form a very common sediment, varying in color from nearly white to dark red. Urine generally acid.

Oxalate of lime is generally deposited from urine which is acid and contains much lithate.

Phosphatic deposits may arise from excessive secretion of the mucus of the bladder, or from a primary alkaline or insufficiently acid state of the urine.

When a patient is secreting the red crystalline gravel, or has a *fit of the gravel,* as it is called, he generally complains of great pain in the loins and bladder, frequent desire to make water, and aching of the testicles and hips; sometimes there is feverishness, with langour and dyspepsia.

Treatment.—The patient should be treated on general principles: if he is lusty, with red lips, has been living highly, and has not been long an invalid, he will generally be relieved by purgation, a reduced diet, warm baths, and liq. potassæ, in doses of ʒj, thrice daily, after meals. Exercise, temperance, and restricted diet will correct this diathesis.

But if the urinary deposit is caused by feebleness of the powers which ought to convert food into healthy flesh and blood, or by overwork, the treatment should begin with judicious purgation, with change of diet and air, and a persistent tonic course; nitro-muriatic acid may be given with benefit; quinine, nux vomica, muriated tincture of iron, etc.

Various Kinds of Stone.—The chief varieties are the uric acid, phosphatic, mulberry and mixed calculi.

Lithic or uric acid stones are generally oval, flattened, fawn or mahogany colored. This stone may be dissolved by boiling in liquor potassæ; it burns away under the blowpipe, and if digested in nitric acid, and evaporated at a very gentle heat, it leaves a residue which, when cold, becomes purple, if exposed to the vapor of ammonia (murexid test).

Triple phosphate forms white or pale gray stones. When treated with liquor potassæ evolves ammonia; is soluble in acetic and muriatic acids.

The **mulberry stone** is composed of oxalate of lime. It is dark red, rough, and tuberculated. It is not dissolved by boiling in potassa; is soluble in nitric acid; exposed to the blowpipe, the acid is burnt off and quicklime is left.

STONE IN THE BLADDER.

Symptoms.—Irritability of the bladder, with frequent irresistible desire to make water, occasional sudden stoppage of the stream of water during micturition, and the stream flowing again if the patient throws himself on his hands and knees, occasional pain at the neck of the bladder, pain in the glans penis, and frequently passage of blood and crystals of uric acid or oxalate with the urine; if a child, there will be elongation of prepuce, from his attempting to alleviate his pain by pulling at the organ; children are often troubled with priapism.

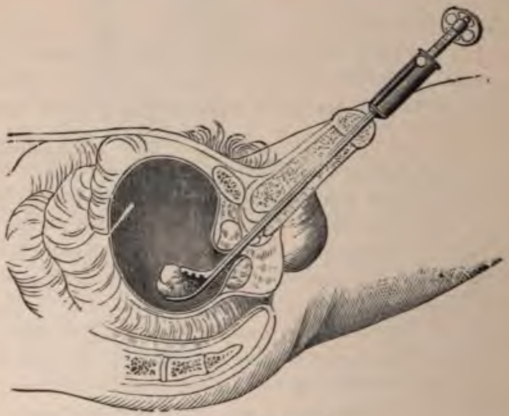


FIG. 124.—Lithotrity.

But to make sure of the existence of stone, a *sound* must be employed, when it will be made sensible to the touch and to the ear. The *sound* is a solid steel rod, of the size of the medium catheter; its handle is polished, and its shaft is smaller at the end, so as to move easily into the urethra. Sometimes the stone cannot be felt, either on account of an enlarged prostate, or because cysts or pouches exist in which the foreign body is hidden; again it may be covered by a thick layer of closely adherent mucus.

All cases of stone or where such is suspected should be carefully radiographed and the resulting plate examined upon the view box.

The symptoms of stone vary in severity, according to its size and roughness, the state of the urine, or the condition of the bladder, whether healthy or inflamed.

Treatment.—The indications are to get rid of the abnormal condition of the urine, to allay pain and irritation, and to remove the stone. The first two measures have already been spoken of.

Lithotrity and *Lithotomy* are the methods pursued to remove the stone.

Lithotrity is an operation for crushing stone in the bladder into fragments of so small a size that they may readily be expelled through the urethra; the instrument generally used is the lithotrite of Bigelow.

The best cases are those with a urethra of full size, and a bladder neither irritable, contracted, nor paralyzed. The danger is in mechanical injury to the bladder.

The patient should be placed on his back, on a couch, with his head on a pillow, knees gently raised and supported, and a little apart. The pelvis should be raised above the level of the shoulders.

The object is to get the stone away from the neck of the bladder. The bladder should hold from four to eight ounces of water. The instrument, warmed and oiled, is now to be gently introduced and passed fully into the bladder. The next step is to seize the stone; this is done by applying the instrument to the stone, so as to seize and lift it, by *rotating* the instrument upon the axis of its shaft. When the stone is fairly grasped, the screw is employed to crush it; at the end of the operation it must be seen that the blades are entirely closed and not choked by detritus, while the instrument is withdrawn.

Subsequently, pain must be relieved by opiates. Hip baths and demulcent drinks must be used to ally irritation. The operation must be repeated at intervals, till every fragment is crushed and expelled. This procedure is only to be done by the experienced man. The novice and the lithotrite are most dangerous to the welfare of the patient. One not skilled in the use of urethral instruments never should do the crushing operation.

Lithotomy.—There are several methods by which lithotomy may be performed.

1st. The **Lateral Operation.**—The bladder may contain a little water; the bowels should be cleared previously by an enema.

A good firm table, 2½ feet high, is necessary for the operation. The patient should lie down and ether be administered. The sound or a staff should then be introduced and made to touch the stone, if possible, so that there may be no mistake. The patient should then be placed on his back, with his shoulders raised by a pillow. Then the perineum should be thoroughly exposed; the thighs must be raised and separated; knees bent, and each foot must be grasped with the hand of the same side. The hand and foot must then be firmly bound together with a bandage. The buttocks should be brought to the edge of the table and the perineum shaved. An assistant on each side holds the thighs asunder; the surgeon places the fingers of the left hand on the right buttock, and with the thumb fixes and steadies the integuments of the perineum, taking care not to draw them up. He then makes a free incision of the skin and subjacent tissues, entering the knife just on the left side of the raphé, about one and three-quarter inches in front of the anus, and cutting downward to midway between the anus and the tuberosity of the ischium. The blade of the knife should next be run along the surface of the exposed fat and cellular tissue, and then the forefinger of the left hand thrust into the wound, about its middle, and directed upward and forward between the left erector and accele-

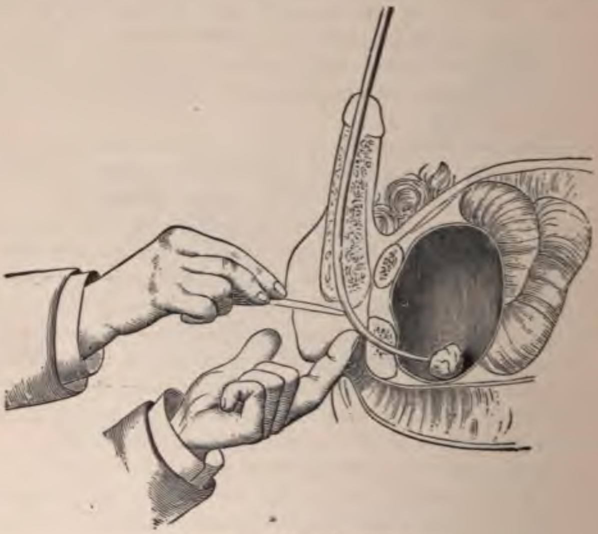


FIG. 125.—Lateral Operation.

rator muscles; the finger then feels the groove of the staff in the membranous part of the urethra.

The left forefinger nail is now to be well fixed in the groove of the staff, the knife is slipped in over it, with its flat surface obliquely placed; its points made to slide along the groove toward the bladder, dividing the membranous part of the urethra and the edge of the prostate. The knife being withdrawn, the left forefinger is gently insinuated along the staff. Next the assistant removes the staff and the surgeon introduces the forceps over the finger into the bladder.

2d. The **bilateral operation** is performed by making a curved incision, with the convexity upward, from one side of the perineum to the other, carrying it between the anus and the bulb of the urethra, opening the membranous portion of the urethra, and then pushing the *bistouri caché* into the bladder, by which both sides of the prostate may be divided.

3d. **The rectovesical operation** consists in cutting into the bladder from the rectum, in the middle line behind the prostate; this is to be condemned. The lateral-bilateral and recto-vesical operations have been largely supplanted by the suprapubic.

Suprapubic Cystotomy.—This operation is performed in cases of retention of urine, due to hypertrophy of the prostate gland for the purpose of removing tumors, or stone in the bladder.

The day before the operation the bowels should be well opened, and just prior to commencing an enema of warm water should be administered; the hair should be shaven from the pubis, and the skin prepared in the usual manner.

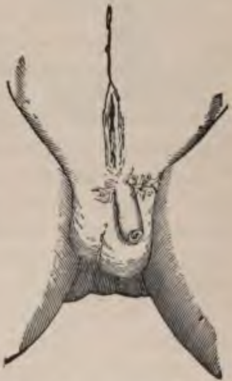


FIG. 126.—Suprapubic Lithotomy Incision seven days after the operation. Upper angle of wound was sutured.

A soft rubber catheter is next passed into the bladder, and the urine drawn off. A Colpeurynter bag is oiled and inserted into the rectum, which is then distended with from ten to twelve ounces of warm water, the bladder receiving from eight to ten ounces of warm boracic acid solution; the catheter is then removed and a rubber band applied around the penis to keep the fluid from escaping.

An incision is now made three inches in length, beginning one an inch below the upper edges of the pubis, and extending upw keeping in the median line and going through the various structi until the transversalis fascia is divided, when some loose connec tissue and fat containing large veins will be reached; these must separated with a pair of thumb forceps until the bladder is reach this can be distinguished by fluctuation, color, and the arrangem of the muscular fibers. Now seize the bladder transversely by a t culum in the upper portion of the wound, hold it steadily with the hand, and open it with a scalpel, cutting toward the pubis. Alv follow the knife in by the finger; this procedure prevents the es of the distending solution, and hence greatly facilitates location of stone. After the foreign body is removed, the band is taken from penis, the rectal bag emptied and withdrawn, a small drainage tub inserted in the lower angle of the wound, and the other portions of opening closed with sutures. Any bleeding vessels must be secured the case treated as an ordinary abdominal section. Should the bla be thickened then it becomes necessary to insert drainage. This is accomplished by inserting a large calibre fenestrated rubber tube al to the bas fond and stitching the same to the margin of the skin. tube should be about four feet in length and so constructed as to d continuously into a vessel at the foot of the bed. The drainag allowed to remain in for from four to five days, when it is removed continuous catheterism practiced, the wound healing by granulation.

HARE-LIP.

Hare-lip is a congenital fissure of one or both lips; generally per dicular, but it may be more or less oblique.

As a rule, the division is just below the septum of the nose, b sometimes corresponds to one of the nostrils.

Hare-lip may be single or double; single when the fissure is onl one side, and double when there are two fissures with a small fla skin between.

In the operation for the relief of hare-lip the principle is unio the first intention.

Fundamental Principles of Hare-lip Operations.—Modified (Binnie): 1. No tension upon sutures, merely good approximation.

2. Edges well freshened and all adherent bands divided.

3. *The lines* of incision for freshening are so made as to lea

small teat-like projection at margin of lip. This prevents dimpling and the formation of a notch.

The operation should be done, if possible, between the third and sixth months of life. Have the child in the very best possible condition.

If the case is one of single hare-lip, detach freely the lip from the bones behind, then pare off the edges of the fissure by means of a small bistoury; care must be taken to cut off a sufficient quantity of the edge, as at the margin the parts are apt to be callous. The surgeon pierces the lip with a narrow knife at the top of the fissure, just under the nose, and carries the instrument downward, so as to shave off the edge of the fissure; the operation is then repeated on the other side, and the two strips are then detached at the upper angle. The parts are now brought accurately together by silkworm gut, and retained in their positions by sutures. Three sutures should be used for the purpose; the first is put at the edge of the red margin of the lip, and the two others at equal distances higher up. If the hair-lip is double, the operation should be conducted as in single hare-lip, but the closure of the second fissure should not be attempted for at least two weeks after the first operation. Hare-lip pins may be used instead of sutures. After operation the child should be kept quiet and fed regularly.

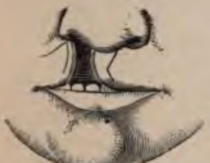


Fig. 127.—Hare-lip Showing Lines of Denudation.

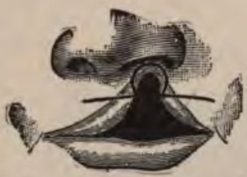


Fig. 128.—Incision of Malgaigue. (*Binnie.*)

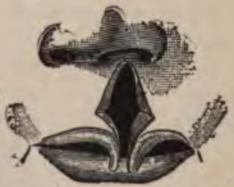


Fig. 129.—Malgaigue Incision. (*Binnie.*)

AFFECTIONS OF THE NASAL PASSAGES.

FOREIGN BODIES IN THE NARES

should be removed as soon as possible; their removal may be effected by a small spoon or canula. If they cannot be brought through the nostrils, they should be gently pushed back into the throat.

EPISTAXIS.

Hemorrhage from the nose may be produced by injury, by vascular excitement, plethora, or determination of blood into the head, by the suppression of some other discharge, by irritation of the mucous membrane, by passive draining of venous blood, and by a want of tone or contractility in the blood-vessels.

Treatment.—Ordinary cases of epistaxis can readily be controlled by simply closing the nostrils with the thumb and forefinger for the space of ten minutes, at the same time breathing through the mouth. If the patient be full-blooded and plethoric, and subject to headache and giddiness, a purgative should be administered and the diet regulated; if the bleeding continues, aromatic sulphuric acid should be given, and if the patient be anæmic, iron and quinine should be used. If it is a *passive hemorrhage,* depending on general cachexy, the patient should be kept quiet in a cool room; he should lie with his shoulders raised; he should suck and swallow pieces of ice, and should apply ice or ice-cold water to the nose and forehead, and a bladder of the same to the nape of the neck. In persistent cases, plugging the nostrils is necessary. This is done by Bellocq's canula, which is a curved silver tube, in which lies a curved spring, having at the end an eye for the reception of a piece of string; this is drawn into the canula, the curved end of which is passed along the floor of the nostril. The spring is then

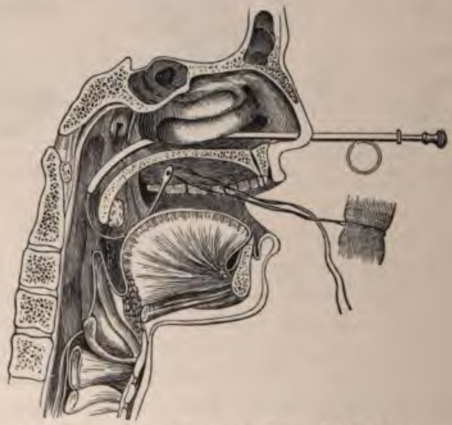


FIG. 130.—Application of Bellocq's Canula.

protruded by pushing the handle, causing the spring and string to appear in the back of the mouth below the soft palate, where it can be secured with the finger and forceps. The end of the string in the pharynx is then brought through the mouth, and a piece of soft sponge is tied to it; then, by pulling the string back through the nose, the sponge is thrown into the posterior opening of the nostril, leaving one end of the string in the corner of the mouth. The anterior nares should then be plugged by a fold of lint passed on the end of the probe and tied in by the nasal end of the string.

FOREIGN BODIES IN AIR PASSAGES.

The foreign body may be impacted in the ventricles of the larynx, or in the trachea, in which case it will probably produce violent spasmodic cough and difficulty of breathing, together with fixed pain in one particular spot, a croupy sound during respiration, readily detected by the stethoscope, loss of voice, and probably acute inflammation.

It may be loose in the trachea, especially if it be a pebble, grain of corn, or coffee, or other smooth substance. In such case the violent coughing and sense of suffocation produced by the first introduction of the article generally subside for a time, but every now and then there are violent fits of coughing and spasmodic difficulty of breathing, during which the substance may be heard by means of the stethoscope.

It may have passed into one of the bronchi, where it is frequently detected by causing a whistling or murmuring sound, and it may be dislodged and driven upward when the patient coughs. The right bronchus is that into which it generally falls.

Treatment.—Very little time should be wasted in attempting to get rid of the foreign body, until the operation of laryngotomy or tracheotomy is performed; it may be well, however, if the substance is movable and round, to place the patient on the bed and administer an opiate, when it may become coated with mucus, and may be expectorated during coughing or vomiting, or when the patient is narcotized he may be quickly turned upside down, when the foreign substance may suddenly be ejected; these devices failing, if the substance is arrested sufficiently high up, the surgeon must resort to laryngotomy.

Laryngotomy is performed by cutting longitudinally through the skin, then horizontally through the *crico-thyroid* membrane, which may be felt as a soft depression an inch below the *Pomum Adami.*

Tracheotomy is performed by the surgeon standing on the left of the patient, whose head being thrown back, an incision an inch and a half or two inches long is made exactly in the middle line, from near the top of the sternum to the cricoid cartilage. The skin and superficial fascia are cut through; the sternothyroid muscles separated and a few fibers divided with the point of the knife; the loose cellular tissue and veins are cleared from the front of the trachea with the forceps, the thyroid gland is pushed up, a pair of slender hook forceps fixed in the trachea, so as to slightly draw it up; while the trachea is stretched, the surgeon passes his knife at the bottom of the wound and carries it upward, so as to divide two or three rings of the trachea.

Various other methods of performing tracheotomy have been devised, which the student can see by consulting larger works on Surgery; together with descriptions of tracheotomy tubes that are in use.

Intubation of the Larynx.—A suitable tube is selected, threaded with a long loop of silk, and fitted on a guide. This is screwed on to the introducer and a gag placed in the mouth on the left side.

The operator hooks the loop attached to the tube round the little finger of his left hand, and passes the index finger over the tongue on to the epiglottis, following it up closely with the end of the tube in his right. He then hooks the epiglottis forward, and slips the tube over it, when, if suddenly turned down and kept in the middle line, it must pass into the larynx, or over it onto the arytenoid cartilages, and so guides the canula. The moment it is in position the sliding tube should be shot forward, the guide drawn back, and the canula pushed on with the finger. The object of the loop of silk is to withdraw it, should it have missed the proper opening or passed into the pharynx.

The immediate effect is a violent fit of coughing; as soon as this ceases the loop may be cut, the silk drawn out, and the tube left.

Extraction, being more difficult, may require an anæsthetic. The forceps are introduced closed; the jaws separated from each other by touching a lever. The serrations are on the outer surface, so that there is no difficulty in holding the tube if it is once grasped.

AFFECTIONS OF THE EAR.

Accumulation of Wax, mixed with hair and cuticle, is a frequent cause of deafness. The patient complains of loud noises, and of a feeling of discomfort and defective hearing. An examination with the speculum will allow the wax to be seen. It will generally be removed by syringing, but should it not be brought away after two or three efforts, the best plan is to fill the meatus with glycerine, stop it with a bit of cotton, and let it remain for twenty-four hours, to soften the wax. The syringe may then be used again. A drop or two of olive oil, or of glycerine, should be inserted after syringing. The water used should be warm enough to be comfortable.

Small Follicular Abscesses frequently form within the meatus, especially in persons of weak constitutions. They are apt to recur and are very painful. Fomentations as hot as can be borne, the application of a leech, or some preparation of opium give relief. When the abscess is bound down by tough skin, a puncture will relieve the pain promptly. If the pain is very great, the patient should be given a dose of morphia.

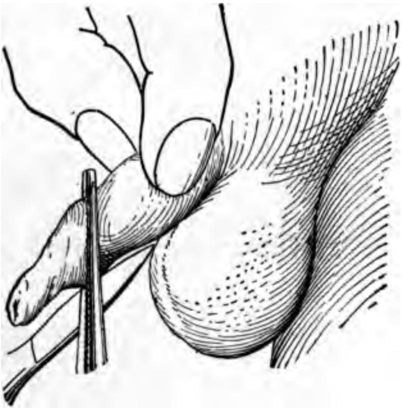


FIG. 131.—Application of Forceps to Foreskin. (*Veau.*)

Eczema of the Auricle is apt to produce thickening of the lining membrane of the meatus and membrana tympani.

The treatment consists in giving, during the *acute* stage, purges, and applying soothing fomentations; in the latter stage the black wash may be used as an injection, or dilute ointment of nitrate of mercury. Tonics and alteratives should be administered, such as quinine, iodide of potassium, cod-liver oil, etc.

PHIMOSIS AND PARAPHIMOSIS.

Phimosis is a constriction of the prepuce, which prevents the glans from being uncovered.

It may arise from inflammation of the cellular tissue and effusion of serous matter into it; it is frequently the result of chancre.

If congenital, this disability may be removed by gradual dilatation with sponge tents, or daily distention.

For radical cure, the operation for circumcision may be performed. If this operation is performed, the foreskin must be drawn out, held between the blades of the forceps, and then cut off at an angle as shown in Fig. 131, after which the mucous lining should be turned up so as to uncover the glans. It is well to make a small cut in the margin of the skin on the dorsum of the penis corresponding to the slit in the mucous membrane. This acts as a guide in suturing and prevents the formation of a constricting band when the organ swells. The excess of mucous membrane is then trimmed away as shown in Fig. 135. The [illegible] rviceable dressing is one of sterile gauze saturated with lead

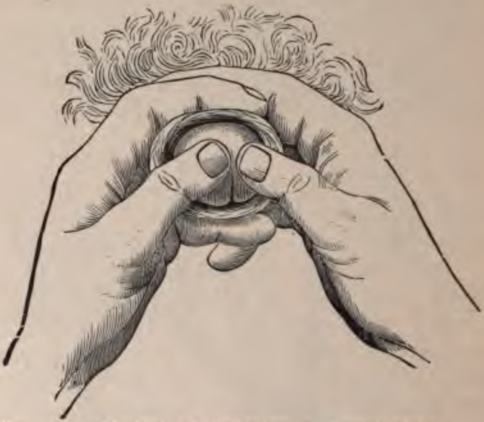


FIG. 132.—Method of Reducing a Paraphimosis.

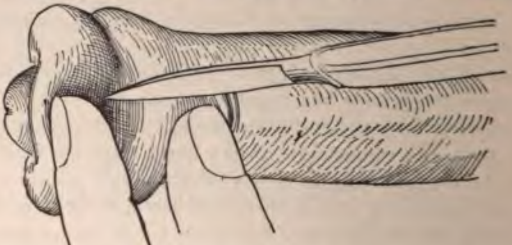


FIG. 133.—Incising Constricting Band, Paraphimosis. (*Veau.*)

water and laudanum. Sutures should be passed through the margin of the incision, to draw together the edge of the skin and the mucous lining of the prepuce. For this purpose the interrupted suture should be used, made of silkworm-gut or cat-gut.

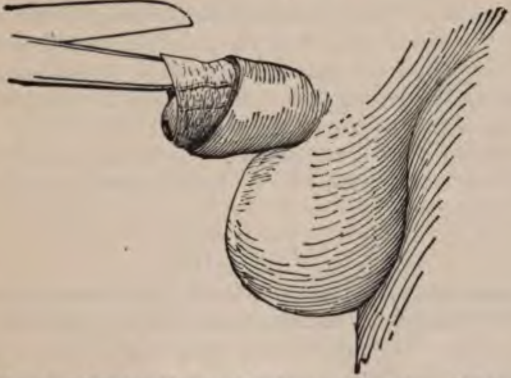


FIG. 134.—Incising Mucous Membrane of Foreskin. (*Veau.*)

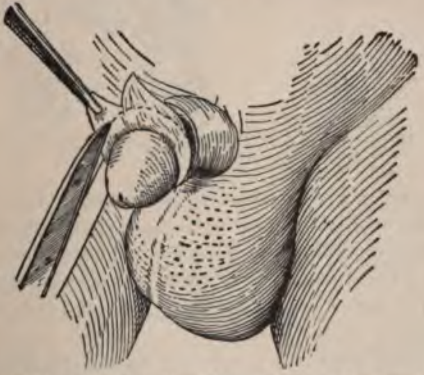


FIG. 135.—Removal of Dog Ear Flaps from Mucous Membrane of Foreskin in Circumcision. (*Veau.*)

Paraphimosis is a constriction of the prepuce from inflammation, so that the skin, having been pulled back, cannot be again drawn over the glans penis.

Treatment.—The object is to reduce the strangulated part as quickly as possible. The penis being greatly distended with blood, take hold of the glans between the fingers, and endeavor to empty the vessels by gentle pressure. When this has been continued for a few moments, endeavor to reduce it by pushing the glans back, and at the same time drawing the skin of the penis forward. If the paraphimosis is not relieved by this treatment, it will be necessary to divide the stricture with a bistoury. Do this by separating the skin on each side; then insert a director under the stricture and divide it, which will allow the skin to be readily drawn over the penis. Then apply cooling lotions.

HYDROCELE.

Hydrocele is an accumulation of serum in the tunica vaginalis testis. It may be of the tunica vaginalis and of the spermatic cord.

The swelling of hydrocele of the tunica vaginalis first shows itself at the lower part of the scrotum, and gradually rises until it arrives at the abdominal ring; it is of a pyriform shape, largest two-thirds of the way downward, less at the bottom, and smallest at the ring. Usually it is attended with pain. Commonly there is no discoloration of the scrotum. The ordinary situation of the testicle is two-thirds of the way down the tumor at the posterior part, but it may sometimes be found in front or at the bottom.

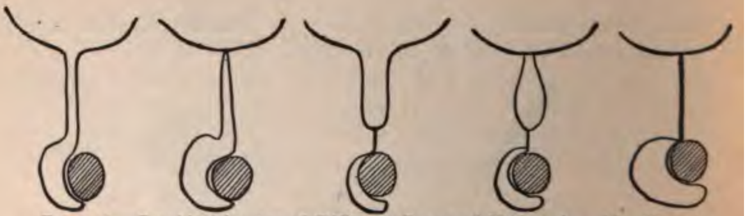


FIG. 136.—Graphic Diagram of Different Forms of Hydrocele. (*Da Costa.*)

The diagnostic signs are a sense of fluctuation, transparency, lightness, freedom from pain. In very old cases the tunica vaginalis becomes much thickened and the transparency may be absent.

Varieties of hydrocele after Da Costa: (1) Congenital, (2) infantile, (3) funicular, (4) encysted, (5) vaginal.

Congenital Hydrocele.—When the tunica vaginalis preserves its communication with the abdomen, and then becomes filled with serum, forming a cylindrical tumor, extending to or through the abdominal ring, it is called congenital hydrocele. On being raised and compressed the fluid is slowly squeezed into the abdomen and slowly trickles down again afterward.

Treatment is either palliative or radical.

The evacuation of the serum and the wearing of a properly fitting truss constitutes the palliative treatment; this is accomplished by a puncture with a grooved needle, or a small trocar and canula. The inner surface of the sac should be scarified by the needle so as to effect adhesions and the closure of the funiculiform process. Palliative treatment is sometimes sufficient for children, but rarely so in the case of adults.

Operation for Palliative Treatment.—The surgeon grasps the tumor behind and passes a trocar and canula into it, pointing the instrument slightly upward, to avoid injuring the testicle. He withdraws the trocar and allows the fluid to escape.

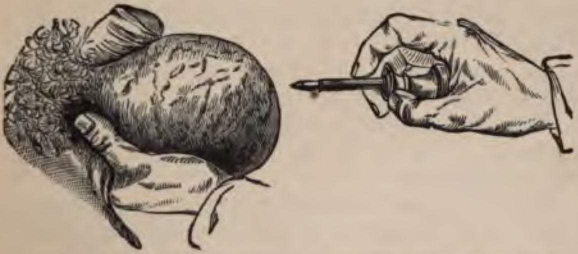


FIG. 137.—Tapping Hydrocele of Tunica Vaginalis Testis.

The radical cure is effected by making an incision into the scrotum and opening the tunica vaginalis testis. The sac is then everted and its margins carried behind the testicle and one or more catgut sutures passed through it to hold it in position. This technique turns the tunica vaginalis inside out and completely obliterates the sac which is bunched behind the testicle, forming a sort of cushion upon which the latter organ rests. Dress the wound antiseptically and keep the patient in bed about one week.

The use of intra-saccular injections of irritating fluids is dangerous and not much used at the present time.

Congenital hydrocele connects with the peritoneal cavity through an enclosed funicular process. The tunica vaginalis is distended by peritoneal fluid; this may be pressed back into the abdomen. Treat by applying truss.

Infantile hydrocele is best treated by puncture, drainage and scarification. It is a collection of fluid in the upper end of the funicular process and the tunica vaginalis. It does not connect with the peritoneal cavity.

Encysted hydrocele of the cord. This is often spoken of as encysted hydrocele. The upper opening of the funicular process is closed and the portion surrounding the testicle is normal. The hydrocele is present in the patent middle portion. Treat by enucleation of cyst.

Funicular hydrocele. The funicular process is patent above and obliterated below. Distension occurs in upper end of process. Treat by application of truss.

If the hydrocele should be one of long standing and the sac has become thickened, a free incision should be made over the long axis of the swelling, the tunica vaginalis testis dissected free, and the sac cut entirely away.

Care must be taken not to injure the cord. Any bleeding should be arrested, the cavity washed with a normal salt solution, a medium-sized drainage tube inserted, and the wound closed by means of silkworm-gut sutures. The tube is removed in twenty-four hours and the sutures on the sixth day.

The foregoing method has entirely superseded the operation by tapping followed by the injecting of various fluids. The palliative treatment is now only employed in the very old, in cases where a radical operation is not advisable, or where the patient wishes to get temporarily rid of the discomfort. The radical treatment is not advisable if the testis be diseased, or if the hydrocele be accompanied by irreducible hernia.

HEMATOCELE.

Hematocele is an extravasation of blood into the tunica vaginalis.

Generally occurs as an immediate consequence of injury of the scrotum; sometimes it arises without any assignable cause. It may follow the palliative operation for hydrocele.

There is swelling of the part, which comes on immediately or soon after the receipt of the injury; it resembles hydrocele, as regards shape. At first the tumor is soft, and fluctuation may be detected, but when *e blood* coagulates it resembles in its character a solid growth.

Treatment.—In a recent case the first indications are to arrest the flow of blood and relieve pain. The horizontal posture, with testicles raised, is necessary; the ice bag and cold lotions must be applied; if the above measures do not suffice or if the blood does not disappear open and turn out the clots. In chronic cases where there are signs of suppuration, a free incision should be made into the vaginal sac, and the cyst and the clot turned out. Then follows the usual treatment to promote healing by granulation.

VARICOCELE.

Varicocele is a varicose state of the veins of the spermatic cord. It is more common on the left side and feels like a bag of earth worms.

Treatment.—Keep bowels open; wash the scrotum frequently with cold water; support scrotum with suspensory bandage, give occasional tonics and assure the sufferer there is no great danger connected with his trouble; if the patient exhibits signs of neurasthenia operate.

The radical cure.—Operations on the veins are always attended with some risk. Cut down on the veins, and ligate them with catgut; this method is known as the open operation.

This operation has largely superseded the subcutaneous method; it is more reliable; there is much less risk of infection; the patient recovers in a shorter time and endures far less pain.

Great care must be taken to prepare the individual; the day before the operation he must be put to bed, and remain there at least seven days. The pubis must be shaved, the parts thoroughly antisepticized, and the bowels completely evacuated. He must be etherized. An assistant pinches up the skin over the enlarged veins; then the surgeon makes an incision three inches long, by transfixion; the veins are separated by means of a dry dissector; a stout catgut ligature is applied at the upper and lower angle of the wound, great care being taken not to include the vas deferens. The veins included between the ligatures are then cut away and the two stumps approximated by tying together the free ends of the ligatures, the wound irrigated with normal salt solution, and the skin closed by interrupted silkworm-gut sutures and dressed in the usual manner.

In cases where the scrotum is pendulous and the veins varicose, the proper method of procedure is to leave the ligatures of sufficient length, so as to tie the uncut ends to each other, and at the same time bringing the severed ends of the veins in apposition. This results in a shortening of the cord.

High Operation.—This operation has been recommended because of the difficulty of properly cleansing the furrows of the scrotum. The pubes are thoroughly shaved and the cord attached through an incision.

CARCINOMA OF THE TESTICLE—CASTRATION OR ORCHIDECTOMY.

This is generally of the soft variety. Gland swells, becomes hard, heavy, and elastic; at this period it is scarcely painful or tender, and merely causes slight aching in the loins from its weight. After a time it enlarges rapidly and feels soft; the cord swells; the pain becomes severe and darting. Secondary tumors form in the iliac fossa, and emaciation, exhaustion, and death follow.

Castration.—The method of performing the operation is as follows: The scrotum being shaved, the operator grasps it behind, so as to stretch the skin, and makes an incision into the tunica vaginalis to examine the testis. If there is no doubt of the diagnosis, the cut is extended to the bottom of the scrotum. If the tumor is very large, two elliptical incisions may be made to remove a portion of the skin between them; then separate the cord from its attachments, an assistant holding it between his finger and thumb, or with a stout pair of forceps, to prevent it retracting when cut, a long, stout ligature being passed through its connective tissue, so that in the event of secondary hemorrhage the cord may at any moment be pulled out. Then pass the bistoury behind the cord and divide, and seizing the lower portion dissect out the testicle. All arteries requiring it are to be tied, and the wound is not to be closed until all bleeding has ceased, as there is frequently secondary hemorrhage.

HEMORRHOIDS.

Hemorrhoids are tumors situated near or in the anus, and are distensions of hemorrhoidal veins, with inflammatory swelling, congestion, and hypertrophy of the mucous or submucous tissue.

Piles are of three varieties, external, internal or mixed; if situated above the internal sphincter they are denominated internal; if between the internal and external sphincters they are external piles. The mixed hemorroids encroach upon both zones.

If they are attended with discharge of blood they are called *open* or *bleeding piles;* when there is no discharge they are denominated *blind piles.*

The *symptoms* of external piles are pain when passing feces, or tenesmus after discharge; at first there is a projection of a livid appearance, which in a few days becomes solid; the blood becomes coagulated in the hemorrhoidal veins. In a few days the pressure of the feces brings down the pile, and it presents itself externally. When inflammation comes on the patient suffers greatly, and can only be tolerably comfortable in a recumbent position.

Treatment of External Piles.—If consulted early, while the pile is only a livid projection, an active purgative should be administered, avoiding such as have particular influence on the rectum, such as aloes. Leeches may be applied in addition. As a local application liquor plumbi acetatis is highly commended.

If the pile has continued until it has become solid, insert a lancet into it, and press out the clot; then apply a cooling lotion, administer a purgative, and the patient will be rid of the disease.

Whitehead's operation is performed when the sphincter is entirely surrounded by large hemorrhoids. The patient undergoes the usual preparation for a rectal operation. After being etherized, he is placed on his back in the position for lithotomy. An incision entirely surrounding the sphincter is made at the muco-cutaneous junction. The mucous membrane in which the hemorrhoids are situated is then dissected from the muscular coat, hemostatic forceps being placed on bleeding vessels. The mucous coat is now brought down below the margin of the anus and the membrane above the hemorrhoid divided transversely and silk sutures are applied to the free margin of the skin below. The parts are irrigated and dressed with iodoform bichloride gauze. The bowels are kept confined for several days, and then moved by means of a saline cathartic. The use of gauze packing in the rectum is often responsible for the pain after the operation, hence it is proper to use but a small amount or none at all.

Internal Piles are frequently accompanied by a high degree of fever, with a sense of weight and pain in the sacrum; pressing at stool causes the disease to show itself by prolapsus ani.

Treatment.—The irritation must be relieved by general and local treatment. Apply leeches and fomentations; if these measures do not cause relief, the pile must be removed by ligature.

FISTULA IN ANO.

This is a fistulous ulcer by the side of the rectum, through the fibers of the sphincter ani.

There are three kinds recognized: 1. The complete fistula, which has one external opening near the anus and another in the bowel above the sphincter. 2. The blind, or incomplete external fistula, which has no opening in the bowel. 3. The blind, or incomplete internal fistula, which opens into the bowels, but not externally.

Treatment consists in the division of the sphincter ani through the fistulous track curettage of the infected area and the insertion of iodoform gauze packing, so as to allow the parts to heal by granulation so as to prevent the contraction of that muscle for a time. Before operating, the digestive organs must be put in good order, and a purgative must be administered, so that the bowels may not be disturbed for at least forty-eight hours.

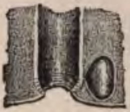


FIG. 138.
Ischio-rectal Abscess.

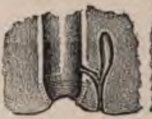


FIG. 139.
Complete Fistula.

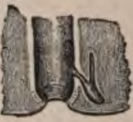


FIG. 140.
Blind Internal Fistula.

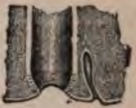


FIG. 141.
Blind External Fistula.

PROLAPSUS ANI.

This is an eversion of the lower portion of the rectum, and its protrusion through the anus. The affection is most common in infancy and old age. It may come from straining or from natural laxity.

Treatment.—The parts should be carefully washed, and then replaced by gentle pressure with the fingers. If there is any difficulty, the forefinger, well oiled, should be pushed into the anus, when it will carry the protruded part with it, after which a thick compress, saturated with some astringent lotion, should be bound to the part by means of a T-bandage. The bowel is to be kept in its place by means of quietude and the recumbent posture, and, if necessary, tonics should be resorted to. Lotions of a solution of alum, sulphate of zinc, decoction of galls, and astringent injections are to be employed, if necessary. Should these means fail the patient should be etherized and the actual cautery should be resorted to; the affected parts should be seared on radiating lines. After the operation great care should be observed not to allow constipation to occur; for at least a year the alvine evacuations should take place in the recumbent posture. In most cases this treatment, with the Faradic current, will effect a cure.

FISSURE OF THE ANUS.

This is a small chap, crack, or ulcer, which gives intense pain during defecation, frequently continuing for some time after the evacuation. It may be the remains of an external pile, and is generally situated behind it, and leads to the fissure.

Purgatives frequently give relief, and lotions of sulphate of zinc, of tannin, nitrate of silver, or sulphate of copper are often beneficial; an ointment of galls with lead may be tried. Should these remedies not answer, *forcible dilatation* may be resorted to, so as to temporarily paralyze the sphincter muscle. To accomplish this the two thumbs, well oiled, must be introduced into the rectum, and then, by firmly grasping the nates with the fingers, the sphincter muscle is dilated by drawing the thumbs apart.

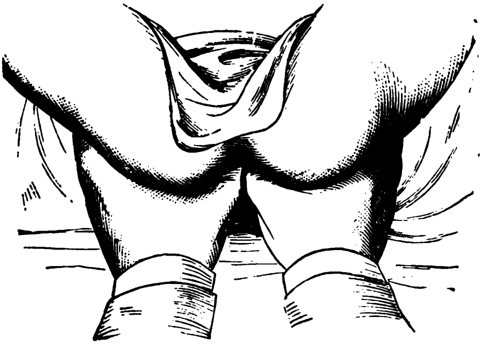


FIG. 142.—Dilating Sphincter in Fissure of the Anus.

Should this means fail, an incision into the part should be made, through the fissure or ulcer, with a straight, narrow, blunt-ended bistoury, so as to divide the mucous membrane, and in severe cases to divide the sphincter. A small piece of lint should be laid in the wound, so that it may heal by granulation.

CARCINOMA OF THE RECTUM

may commence as a distinct tumor, or as an infiltration into the walls of the bowel, causing stricture. The earliest symptoms are uneasiness in the rectum, aching pain in the back, hips, and thighs, and irritation of the bladder. As the disease advances, the bowel becomes more or less obstructed; there is frequent discharge of a fetid muco-purulent matter, streaked with blood, and obstinate constipation attended with swelling of the abdomen, and sometimes with the symptoms of acute obstruction. There may be profuse and exhausting diarrhœa; peritonitis, or perforation of the distended bowels, with exhaustion, terminate the patient's suffering, in death. The history of all cases of rectal should be carefully inquired into as to the probability of stricture. When in doubt anti-syphilitic treatment should be tried.

Treatment.—Keep up the action of the bowels by enemata of warm water and very mild laxatives; allay irritation by occasional leeching, by belladonna and opiate applications, suppositories, or enemata. The patient's strength is to be sustained by tonics, cod-liver oil, etc., etc.

If the case is early seen the rectum should be resected; but if the disease has advanced, but is still in a condition to be removed, resort should be had to the Craskey or Keen Craskey operation.

VARICOSE VEINS. (PHLEBECTASIS.)

Varix is an enlarged and tortuous state of the veins, which are usually thickened, rigid and formed into irregular pouches.

It is most frequently seated on the lower extremities, scrotum and rectum.

Varicose veins of the leg are accompanied by pain, weight, fatigue on taking exercise; they cause ulcers and excoriations of the skin; they sometimes burst, causing profuse hemorrhage, and occasionally blood clots in the veins, which may terminate in an abscess.

Causes. *Predisposing.*—Female sex, middle age, occupation, tight clothing, such as garters.

Active Causes.—Pregnancy, cirrhosis of the liver, syphilis, organic heart and lung diseases.

Treatment.—The *palliative* treatment consists in applying strips of adhesive plaster or the rubber bandage over the part, a common roller, a Martin's roller, or an elastic stocking, which should be applied in the morning, before the patient rises. Galvanism or faradization has been recommended.

For the *radical* cure many methods have been devised; Sir B. Brodie recommended division of the vein by *subcutaneous* section; Watson, of New York, advocates *excision* of a portion of the affected vein; again, potassa fusa and quicklime, to cause slight inflammation, has been suggested. Pressure and the twisted suture both have their advocates. Ligation of all the veins through a circular incision has been recommended (the garter operation). Edema may follow. Elastic stockings may do good.

CLUB FOOT.

This is a deformity of the foot, produced by rigidity and contraction of various muscles of the leg.

Talipes Equinus is where the heel merely is raised, so that the patient walks on the ball of his foot. Rarely a congenital condition.

Talipes Varus.—The heel is raised, the inner edge of the foot is drawn upward, and the anterior two-thirds twisted upward, so that the patient walks on the outer edge, and in extreme cases on the dorsum of the foot and outer ankle.

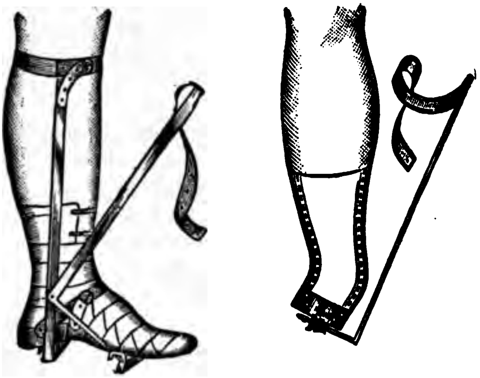


FIG. 143. FIG. 144.
Dr. Allis's Club-foot Apparatus.

Talipes Valgus.—The outer edge of the foot is raised, the longitudinal or inner arch flattened by the sinking of the head of the astragalus, and the patient walks on the inner ankle. Always associated with talipes planus or flat foot.

Talipes Calcaneus.—The toes are raised and the heel is depressed, so that the patient walks entirely upon it. There are also compound varieties, which need not be enumerated in a work of this kind. The true form is congenital and the flexors shortened and tendo-Achilles lengthened.

These deformities may all be congenital, or they may appear after birth.

Contraction and shortening of the muscles are the cause of club foot. In non-congenital cases they may be brought on by spasms affecting many muscles, which may be dependent on a rheumatic fever, or produced by irritation directly from the spinal cord, or they may be sequelæ of bruises, injuries, or diseased joints.

Treatment.—In recent cases remove all irritating causes, soothe spasms, stimulate palsied muscles. If the case comes under the surgeon's notice before the contracted muscles become fixed, use constitutional remedies, fomentations, etc. In slight cases light splints of gutta-percha or wood, with bandages, may be of service.

In severe cases it is better to resort to Stromeyer's operation of *subcutaneous tenotomy*. By this operation the mechanical shortening of the muscle is obviated; the tendon being divided its separated extremities heal by a new connective tissue, which renders it longer, and may be readily stretched while recent.

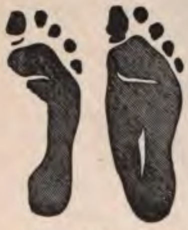


FIG. 145.—Foot Print Outline. *A*, Normal; *B*, Flat Foot.

To perform this operation, the tendon is put on the stretch, and a narrow, sharp-pointed tenotomy knife is thrust through the skin on one side of it, then its edge is turned against the tendon and made to divide it as it is being stretched. Some surgeons prefer to pass the knife under the tendon, and then cut toward the skin, and others pass it between the tendon and the skin and cut toward the deeper parts.

In talipes equinus the tendo-Achillis is cut.

In talipes varus the tendo-Achillis, tibialis posticus, anticus, and flexor longus digitorum are divided.

In valgus the peronei and the extensor longus digitorum are severed.

In some cases it may be necessary to cut a portion of the plantar fascia, or the muscles of the sole of the foot.

Dr. Oscar H. Allis has devised a "club foot apparatus," which can be readily understood by reference to the accompanying figures.

Pes Planus (flat foot).—A deformity of the foot characterized by a flattening of the normal arch.

Etiology.—Rickets, fractures, sprains, general weakness, occupations, ill-fitting shoes, obesity and wasting diseases.

Symptoms.—Pain, breaking of arch of shoe. Observe footprints on glass or paper after wetting.

Treatment.—Improve hygiene, moderate exercise, massage, strapping, the wearing of a metallic arch to afford permanent support.

Pes Cavus (Hollow foot).—A deformity presenting a high arch with shortening of the foot antero-posteriorly. This condition is often caused by infantile paralysis, injury and rickets.

Symptoms.—Pain in walking or standing. The wet footprint shows an absence of the connecting isthmus between the heel and toe outlines.

Treatment.—Massage, strapping, tenotomy and manipulation.

Hallux Varus or Valgus, a displacement of the great toe outward or inward.

Etiology.—Gout, rheumatoid arthritic affections, wearing of narrow or ill-fitting shoes.

Symptoms.—Pain, angular deformity of great toe, enlargement of metatarso-phalangeal joint.

Treatment.—Osteotomy, massage, retention apparatus to hold toe in normal position, strapping, removal of head of metatarsal bone and properly made shoes.

Club Hand.—A rare deformity analogous to club foot. The hand may be either flexed or extended. It is frequently associated with malformation of the radius and carpus.

Treatment.—Manipulation, massage, passive motion, tenotomy or osteotomy.

Knock-knees (Genu Valgum).—A deformity of the knee joint or shafts of one or both legs, allowing the knees to fall inward. One or both knees may be affected.

Treatment.—Administer tonics in children, fresh air and sunshine, a properly fitting brace. In extreme cases osteotomy.

INGROWING TOE NAIL.

This affection is most frequent on the great toe; the incurvation usually exists on both sides, though more frequently on the inner side.

It is generally a source of great suffering, on account of the pressure exerted on the soft part at the side of the toe, which swells, ulcerates, and discharges a foul, fetid fluid, and is covered with tender granulations.

It may arise from an abnormal formation of the nail, but it is frequently produced by the use of tight, narrow shoes.

If the disability is slight the patient may be relieved by the persistent use of scraped lint being inserted under the nail, a small roll of linen laid between the nail and the overlapping skin, and then applying a strip of adhesive plaster so as to keep the parts asunder. In severer cases the most reliable method is to excise the edge of the nail. With a pair of straight scissors the nail is divided its whole length, on a line with the incurvated edge, which is then detached, matrix and all being embraced in the operation. Warm antiseptic dressings or opiated water is then applied and the part kept at rest.

CARBUNCLE, OR ANTHRAX,

is a hard and circumscribed inflammatory spot of the true skin; varying in size, usually forming on the cheek, neck, or back; infiltrated with unhealthy lymph, and is a dull red swelling, very tender to the touch and accompanied by a heavy, aching pain.

Carbuncle is generally preceded by pain, and is from the first a swelling of considerable hardness; the surface of the tumor then assumes a livid redness and a spongy feel; little ulcers now form on the skin, which give it a sieve-like appearance, so numerous are the orifices; from these a whitish discharge exudes. When the little openings are formed into one, the dead cellular membrane begins to escape.

Carbuncles are generally accompanied by great prostration, sickness, loathing of food, headache, and other symptoms of low febrile impression.

Treatment.—It is well to begin the treatment with a calomel purge; after thorough purgation the treatment should be tonic and sustaining; the most suitable articles are quinine, iron, nourishing broths, and brandy. To allay pain and procure sleep an opiate will be needed.

The best topical application is the warm-water dressing, with acetate of lead and opium. Penciling the surface with tincture of iodine, and in some cases applying a blister over the infected part, are highly recommended. S. D. Gross recommends, as a speedy and effectual method of relief, the introduction at, four opposite points of a delicate tenotome; making a subcutaneous division of the wounded tissue in such a manner as to traverse the entire swelling; or, after making the necessary incisions, paint the inflamed area with tincture of iodine, wash the part with bichloride solution, then apply adhesive plaster, leaving an opening for free drainage. Compress with bichloride sponge, and place over this iodoform cotton.

When the disease has passed into gangrene, the remedy is a free incision, the knife being carried through the skin down to the healthy structures beneath. If the dead tissues are slow in coming away, their extrusion may be expedited with the scissors, the surface of the ulcer being well touched immediately afterward with dilute acid nitrate of mercury or solid nitrate of silver, to promote the formation of healthy granulations. Use, several times a day, injections of solutions of chlorinated sodium, carbolic acid, permanganate of potassium, or common salt. When the sore begins to present a healthy appearance dress the parts with opiate cerate, or elemi ointment, or the moist antiseptic dressings. The more modern method of treatment is to remove the diseased area leaving a healthy surface to granulate.

BOIL, OR FURUNCLE.

A **Boil** is a hard, rounded, deep red, raised, and very painful swelling, situated in the sebaceous follicles of the skin, occurring on all parts of the body, usually terminating in suppuration.

A slight pain first attacks some part of the skin, a little swelling appears, which becomes elevated, hard, and of a deep red color, when the pain increases. The swelling becomes white at the top, it breaks, some pus mixed with blood is discharged, and then the destroyed cellular tissue, called the *core,* is discharged, when the surrounding hardness subsides.

Treatment.—The usual treatment is to apply an antiseptic poultice to the part and make a free incision to let out the contents. For indolent boils a good application consists of glycerine and extract of opium, each a drachm, resin cerate, an ounce; it relieves the pain and irritation. Painting the part with tincture of iodine, or solution of nitrate of silver, are both recommended. Should the patient's condition require them, tonics should be employed, and when there is a tendency to recurrence, Fowler's solution, in doses of two or three drops, thrice daily, will be found efficacious.

According to Dr. Ringer, the sulphides possess the power of checking the formation of pus. Calcium sulphide, given in doses of a tenth of a grain hourly, is recommended where there is a succession of boils.

Always examine the urine for sugar in cases of carbuncles and boils; this is particularly important in old people.

HOUSEMAID'S KNEE

is an inflammation of the bursa of the knee, between the patella and skin, which is common to housemaids, from kneeling. It is usually chronic, but may be acute. It causes great pain and swelling; it differs from inflammation of the synovial membrane by the swelling being most superficial, and in being in front of the patella, which is obscured by it; in inflammation of the synovial membrane of the knee, the patella is thrown forward, and the swelling is most prominent at the sides.

Treatment.—Rest, leeches, fomentations, purgatives and blisters; if these do not bring relief, an incision should be made into the swelling. After evacuating the contents of the sac it should be packed with iodoform gauze and allowed to heal by granulation. Some surgeons use irritating injections; these are dangerous and should rarely be employed.

"Miner's" Elbow.—This is a condition similar to housemaid's knee, affecting the olecranon bursa. Treat the same as housemaid's knee.

Weaver's Bottom.—A thickening of the bursæ of the tuberosities of the ischia, sometimes seen in weavers.

WHITLOW. (FELON.)

Paronychia, or **Whitlow,** is an abscess of the thumb or fingers.

The superficial whitlow consists of inflammation of the surface of the skin of the last phalanx, with burning pain or effusion of a serous or bloody fluid; it is generally seated immediately around and beneath the nail; it is attended with great pain and throbbing, and suppuration at the root of the nail, which may come off.

The deep-seated variety, *tendinous whitlow* or *felon*, as it is called, is attended with severe, throbbing pain, exquisite tenderness, light, but tense and resisting swelling, and very great constitutional disturbance. It may lead to suppuration, the matter extending itself along muscles and tendons from the fingers to the palm. Involvement of the thumb and little finger is more likely to be followed by palmar abscess because of the thecal connection, and even to the forearm, causing sloughing of the tendons, with severe irritative fever, sometimes placing life in danger and frequently leaving the limb stiff and useless.

If purgatives and fomentations do not speedily bring relief, the finger must be freely laid open. Do not wait for the formation of pus. The knife, used early, should be carried deep enough to feel the resistance of the bone or tendon; the sheath of the latter should be thoroughly laid bare. If the matter has extended to the hand, an opening should be made until complete drainage is established.

Palmar Abscess.—A thecal abscess produced by a felon may rapidly infect the palmar structures, eventuating in palmar abscess, a most dangerous condition and one requiring immediate free incision and drainage.

Treatment.—Place the patient under the influence of an anesthetic, make an incision in the line of the metacarpal bones and below the palmar arches. In severe cases it often becomes necessary to make multiple incisions and occasionally to make counter openings upon the back of the hand with through and through drainage. If swelling and infection has occurred above the wrist free drainage must be secured.

Dress upon a splint and apply hot antiseptic fomentations. The use of tonics and whiskey is admirable.

DROWNING.

Treatment of Drowning.—Let the head hang for *ten seconds,* so that any water may run out of the mouth; then lay down the body with the head raised; put the fingers in the mouth and draw the tongue well forward; wipe out the mouth and throat; strip off the wet clothes; wipe all parts of the body perfectly dry with warm cloths. If breathing has not quite ceased, rouse the circulation and respiration by friction of the entire surface, occasionally dashing cold water on the face, neck, and chest, and then wiping quite dry with a warm towel; tickle the nose and fauces, to excite sneezing, coughing, or vomiting. If breathing should not be thoroughly restored by these means artificial respiration should be resorted to. There are several methods recommended.

1. **Abdominal and Thoracic Pressure.**—The operator kneels by the patient and places his hands near together, with the fingers pointing toward the head, the two thumbs approaching a little beneath the lowest point of the sternum, and the balls of the thumbs lying in the epigastrium, about three inches apart; the lower and thick part of the hand

is firmly pressed downward, and as this part of the hand descends the fingers exert firm pressure on the lower part of the thorax. The pressure is continued until *one, two, three* be counted without hurry, when the hands are suddenly raised from the lower part first; and the chest, which has been emptied by the compression, is allowed to refill with air by its own elasticity. The process is repeated as often as necessary.

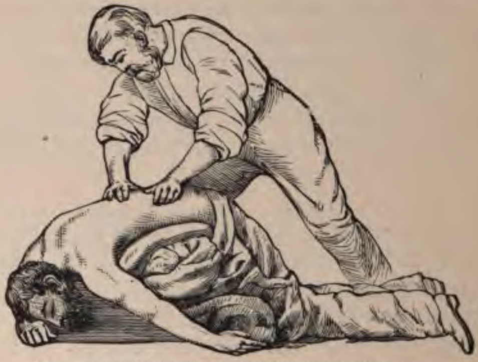


FIG. 146.—Abdominal and Thoracic Pressure.

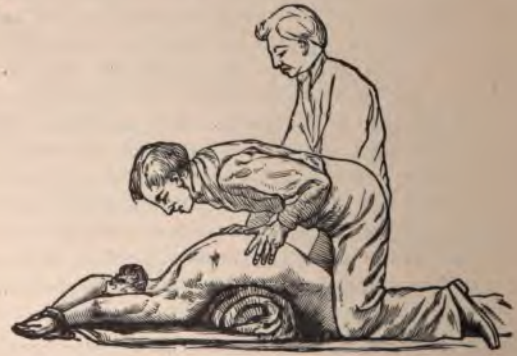


FIG. 147.—Chest Pressure.

2. **Chest Pressure.**—Professor Howard's plan: The patient is laid on his back, with a roll of clothing beneath the loins, so as to make

the short ribs bulge prominently forward, and raise them a little higher than the level of the mouth. The arms are then stretched forcibly back over the head, crossed, and held in this position by an assistant, who also holds the tip of the tongue over one corner of the mouth, grasping it with a dry handkerchief. The operator then kneels astride the patient's hips, and, with his hands resting on the stomach of the patient, spreads out his fingers so as to grasp the waist about the short ribs. He next throws all his weight steadily forward upon his hands, while at the same time he squeezes the ribs deeply, "as if he wished to force everything in the chest upward out of the mouth." This pressure is continued while *one, two, three* can be slowly counted, when it is suddenly removed with a final push, which springs the operator back to his first kneeling position. After an interval, during which *one, two, three* can be slowly counted, the pressure is repeated and the process continued as long as necessary.

FARADIZATION.

A valuable aid to artificial respiration is faradization. A needle connected with the free end of one of the conductors is placed under the skin in the neighborhood of the right phrenic nerve; or, if preferred, over the *pomum Adami;* the other conductor, with a moist sponge attached, is applied on the right side of the chest at the level of the sixth intercostal nerve, or about an inch below the lower end of the sternum. The current must be strong enough to cause contraction of the muscles of the ball of the thumb, and the skin thoroughly moistened with salt water.

BANDAGING.

Bandages are made of unsized muslin, gauze, flannel, linen, calico, cloth, or india-rubber, in lengths of from two to ten yards, and in widths to suit the purposes for which they are needed; ordinarily, unbleached muslin is preferred.

A bandage should have a width of three-quarters of an inch for the fingers or toes; two to two and a half inches for the upper limbs; three inches for the lower limbs, and six inches for the body.

When a bandage is tightly and evenly rolled, it is termed a *roller*.

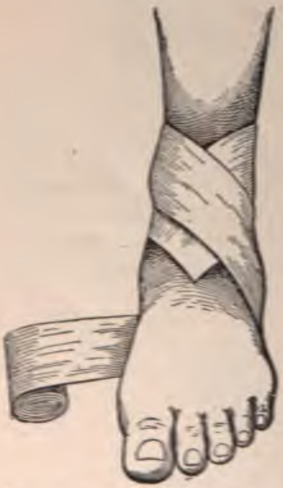


Fig. 148.—Method of Fixing Bandage of Ankle. (*Davis.*)

Fig. 149.—Single Roller. (*Davis.*)

Bandages are designated single-headed or double-headed rollers, according as they are rolled into one or two parts. The ordinary roller in general use is the single-headed.

When applying a bandage, the dresser should grasp the roller in one hand, holding the loose end in the other; apply it to the limb so that the *outer surface* may be against the skin, and so that the bandage will lie close to the limb.

The *spiral* is most frequently employed in the treatment of affections of the extremities, or trunk.

In applying the *spiral,* each turn must cover at least one-third of the one below. Owing to the enlargement of the limbs at the outer part, it is impossible to apply the bandage without making "turns" in it; such a turn is called a "reverse," which is the folding of the bandage upon itself, so that it will fit snugly to the limb. To divide this properly, the student should be careful to remember that a turn should never be made over a prominence of a bone, and, if possible, it should be made on the outside of the limb; also, that when making the reverse the bandage should be held quite loosely, so that with a single movement of the wrist the turn can be made, carrying the hand from supination to pronation.

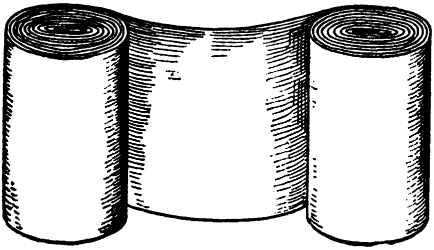


FIG. 150.—Double Roller.

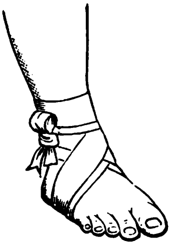


FIG. 151.—Figure of Eight of Ankle.

In making the turn the hand should be held slightly above the level of the limb, and great care must be taken not to unroll more bandage than is actually required.

Figures-of-eight are made by passing the roller alternately upward and downward as it enwraps the limb (Fig. 126). They are used when the enlargement is too great and irregular for reverses to lie evenly, as over the ankle and elbow joints.

THE HEAD.

RECURRENT BANDAGE OF THE HEAD. DOUBLE ROLLER.

The roller for the head should be two inches wide. The best bandage for the head is the capeline (Fig. 127); the double-headed roller is used for this purpose. The surgeon, standing in front or behind, takes one head of the roller and places the middle of the bandage on the occiput or the forehead. The two parts are then brought around and crossed on the forehead or below the occiput. One of the ends is then continued round, and the other, which is lying below it, is turned up and brought over the head, as in the recurrent bandage. It is now met by the other half of the bandage, which has been carried around the head, while the first half has gone over it, and the former, continued round, fixes the bandage so that it can again be brought over the head, when the manœuvre is repeated.

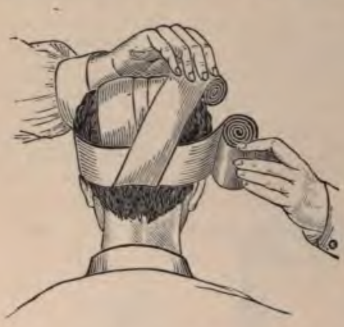


FIG. 152.—Recurrent Bandage of the Head (double roller).

If it be necessary to apply pressure at the side of the head, as in the case of a wound of the temporal artery, a couple of simple turns around the forehead and occiput may be taken, and then the bandage made to ascend and descend alternately as it passes over the point where pressure is to be applied. (Fig. 131.)

RECURRENT BANDAGE OF THE HEAD. SINGLE ROLLER.

Place the extremity of the roller on the lower part of the forehead, then in order to secure the bandage carry it twice around the head from the forehead to the occiput. Reverse the bandage when it is brought back to the median line of the forehead and hold with the finger of the left hand the reversed turn; carry the roller over the top of the head along the sagittal suture to a point just below the occipital protuberance; it is now again reversed; the reverse being held by an assistant while the roller is being carried back to the forehead in an elliptical course, each turn covering in two-thirds of the preceding turn. Repeat these turns with successive reverses at the forehead and occiput, until one side of the head is completely covered; when this is accomplished a circular turn is made from the forehead to the occiput, so as to hold the reverses in place.

The opposite side of the head is now covered in elliptical reverse *turns, made in* the manner here described; then carry the roller around the head from the forehead to the occiput by two or three circular turns, so as to firmly fix those previously made. The necessary pins should be applied where the reversed turns concentrate.

The roller should be eight yards long and two inches wide.

FOUR-TAILED BANDAGE.

The four-tailed bandage answers a very useful purpose when required to retain dressings. It consists of a piece of muslin about three yards in length, split up to within a few inches of the centre, so as to form four strips; the two anterior are carried back and tied under the occiput, while the posterior are fastened under the chin. The position of the tail is reversed according as the middle portion of the bandage rests on the forehead, chin, or occiput.

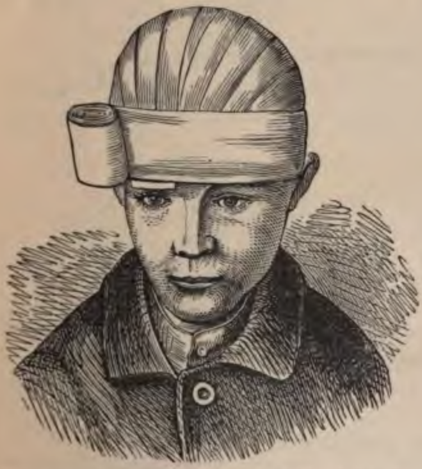


FIG. 153.—Recurrent Bandage of Head (single roller). (*Heath.*)

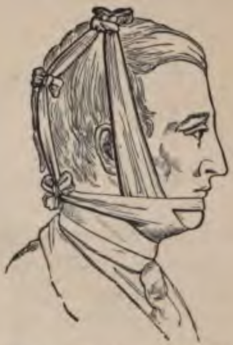


FIG. 154.—Four-tailed Bandage Applied. (*Bryant.*)

BANDAGE FOR ONE EYE.

Make two or more circular turns around the forehead and occiput, passing from right to left, if for the left eye, and from left to right, if for the right eye. After making the second turn, on reaching the nape, carry the roller under the ear of the affected side, and then obliquely up over the jaw and the affected eye; inclining well to the internal canthus, so as to cover the root of the nose, but not the sound eye. Pass across to the temple of the sound side; descend to the nape, and repeat two or three oblique turns, finishing by circular turns around the forehead. (Fig. 130.)

FOR BOTH EYES.

Make two or three circular turns of the head, turning from left to right, or *vice versa;* on reaching the nape, pass under the ear of either side up over the eye, root of nose, and parietal protuberance of the opposite side, and return to the neck. Make two or three of these turns, and then pass from the parietal protuberance around the forehead, across the root of the nose, the eyes and cheek of the opposite side, making an X with the first turns, and repeat in oblique turns, terminating in circular ones.

KNOTTED BANDAGE OF THE HEAD.

To secure pressure on the superficial temporal artery. The articles required in the use of this bandage are a two-headed roller about eight yards in length; some lint; a piece of cork one-third of an inch thick: needle, thread and pins.

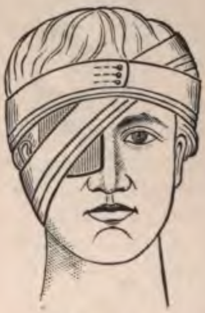


FIG. 155. — Bandage of One Eye.

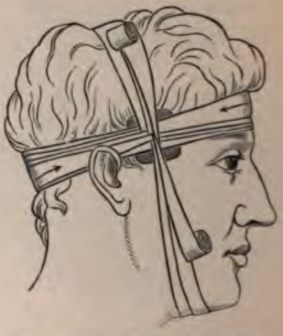


FIG. 156.—Knotted Bandage.

The cork is folded in a piece of lint, and over this are placed several folds of lint so as to make a graduated compress, which is laid on the wound with the small end downward.

One end of the roller is taken in each hand, and the middle is laid over the compress on the wound; the ends are then carried around the head, above the eyebrows, and the other backward below the occipital protuberance, till they meet at the opposite temple, where they are brought from one hand to the other to be brought to the wounded temple.

They are again crossed tightly, one end being carried under the chin, and by the left or right side to the vertex, there meeting the other end, which has passed over the head in the opposite direction. The hands again change ends, and the bandaging continues till each end reaches the injured temple. Here they are again crossed or knotted, when the ends are passed horizontally around the head. The ends are now pinned and cut off. Each knot must overlie its predecessor. (Fig. 131.)

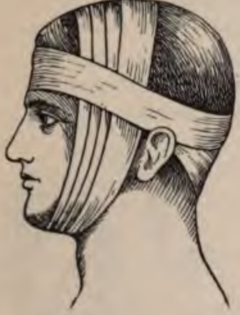


FIG. 157.—Crossed Angle of Jaw (front view). (*Davis.*)

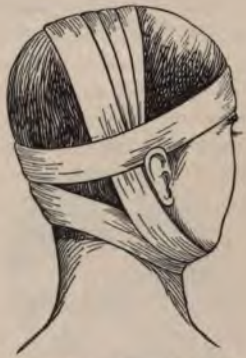


FIG. 158.—Crossed Angle of Jaw (rear view). (*Davis.*)

THE CROSSED ANGLE OF THE JAW.

Required, roller five yards long and two inches wide, together with a thick compress.

Begin with placing the initial portion of the bandage on the forehead and carry it twice around the cranium, turning from right to left, and backward if the disease or injury is on the left side, and *vice versa.* From the nape of the neck carry the roller close under and behind the ear of the sound side, under the jaw to the angle of the jaw on the injured side, and place the compress behind and on this angle. Now carry the roller over the compress, up over the side of the face, between the eye and the left ear; obliquely over the vertex and down behind the ear opposite the injured side. Make three or four oblique turns, and terminate by circular turns around the forehead.

This bandage is used in treatment of fractures of the neck and angle of the jaw; in tumors of the parotid region, and in retaining dressings to this part.

GIBSON'S BANDAGE FOR FRACTURE OF THE JAW.

For this bandage is required a roller five yards long and two inches wide, and a compress or splint, if necessary.

Close the mouth firmly, mould the jaw into proper shape, if necessary, and make the lower teeth press upon the upper; place a compress under the fractured portion, which must be held in place by an assistant; then apply the end of the roller to the top of the head, pass it down the side of the face, under the jaw and over the compress, up the other side of the face to the place of starting; carry the roller around three times; after the third turn make a reverse on the temple, carry it around so as to be perpendicular to the bandage on the face, and surround the forehead and occiput by circulars of the cranium. On the third turn pass from the occiput over the back of the neck and under the ear, to make three circulars of the chin and neck; from the neck pass obliquely upward to go circularly around the forehead. Place pins at each crossing. A strip should be carried from the forehead over the vertex and fastened to the turns on the neck.

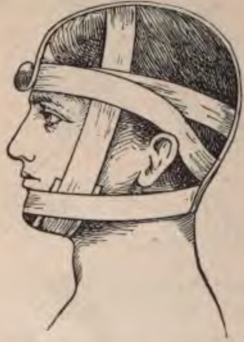


FIG. 159.—Gibson's Bandage. (*Davis.*)

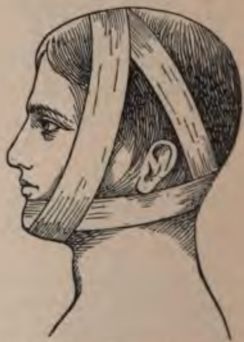


FIG. 160.—Barton's Bandage. (*Davis.*)

BARTON'S BANDAGE.

The roller should be five yards long and two inches wide. The initial extremity should be placed just below the prominence on the os occipitus; then continue the roller obliquely over the center of the parietal bone; across the junction of the coronal and sagittal sutures, under the chin, carrying the bandage over the same direction on the opposite side until you arrive at the back of the head; then pass obliquely around and parallel to the base of the lower jaw, over the chin, continuing the same course on the other side, till it ends where you commenced. Pass the bandage around in this manner three times, and place a pin at the vertex.

BANDAGES OF THE TRUNK.

FIGURE-OF-8 BANDAGE OF NECK AND AXILLA

is used to retain dressings at the base of the neck, before, behind, or above the shoulder. A roller five yards long and two inches wide is used. The initial extremity is placed on the side of the neck, and retained by one or two circulars loosely cast around the neck. If applied to the right shoulder, direct the roller as it comes from the left side of the neck over and behind the right shoulder, so as to confine the required dressing in the axilla or on the shoulder; then bring it up in front and over the shoulder and around the neck to the left side; follow this course, and cover the preceding turn by one-third of the bandage, so as to make a figure-of-8, one turn of which shall embrace the neck, and the other the axilla.

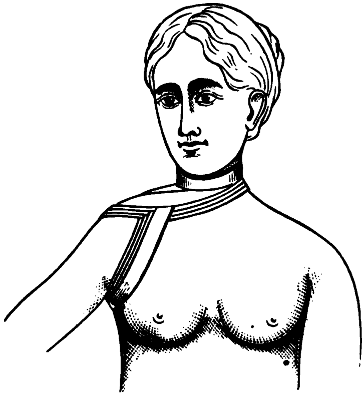


FIG. 161.—Figure of Eight of Neck and Axilla.

ANTERIOR BANDAGE OF THE CHEST (Figure-of-8).

The roller should be eight yards long and two and a half inches wide. The object of this bandage is to draw the shoulder forward, and to retain dressings on the surface of the chest.

Commence at the axilla of either side: take two circular turns around the chest to the place of beginning; from thence carry the bandage obliquely upward across the chest to the shoulder, over the

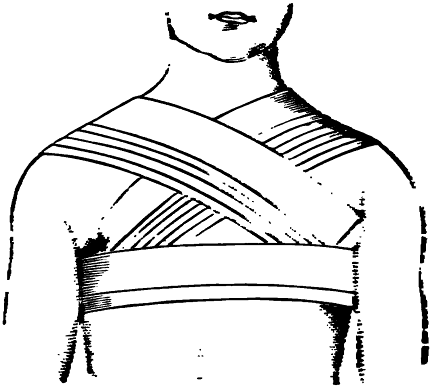


FIG. 162.—Anterior Bandage of Chest.

shoulder backward and downward to the axilla; under the axilla obliquely upward across the chest to the opposite shoulder; over the shoulder backward and downward to the border of the axilla; under the

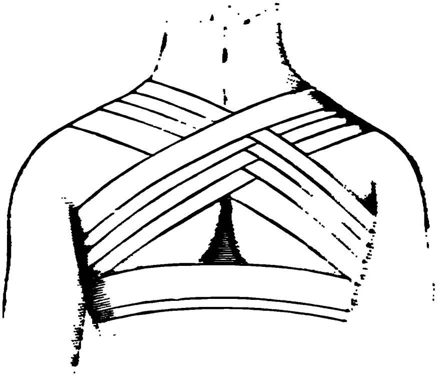


FIG. 163.—Posterior Bandage of Chest.

axilla, repeating the turns three times, and finish by circular turns the chest.

POSTERIOR BANDAGE OF THE CHEST (Figure-of-8).

The roller should be from six to eight yards long and two and a half inches wide. The object of this bandage is to draw the shoulders backward, or to retain dressings on the posterior surface of the chest.

From the left shoulder pass obliquely over the back to the right axilla, the shoulders being forced backward; ascend in front and over the shoulder; pass over the back to the left axilla, over the compresses (if any), in front of this, and around to the back, over it in front, and over the back to the left axilla. Pass over this course until the roller is within three yards of being exhausted, then finish by circular turns around the chest.

SUSPENSORY BANDAGE OF ONE BREAST.

This bandage is used to support the breast. The roller should be eight yards long and two and a half inches wide.

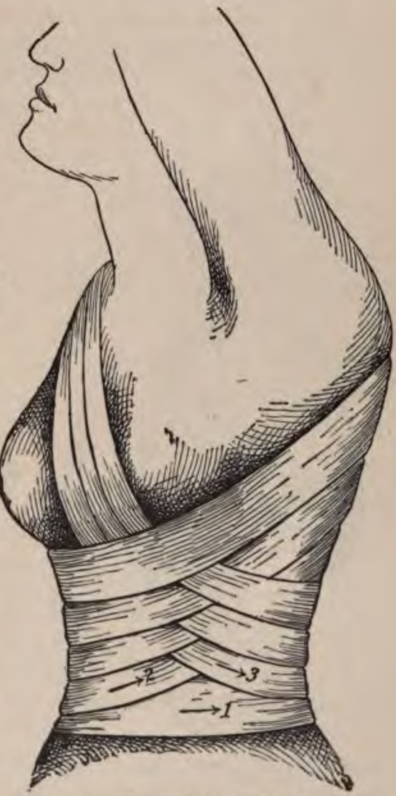


FIG. 164.—Suspensory Bandage of One Breast. (*Davis.*)

Commence at the axilla of the affected side; carry two circular turns under the breast, around the chest to the point of origin; thence obliquely upward under the affected breast; cross the front of the breast to the shoulder; over the shoulder, obliquely downward across the back to the point of origin; then take a circular turn under the breast, around the chest to the point of origin. Continue to take these turns, alternating and advancing in the oblique and circular turns, until the breast is fully supported.

SUSPENSORY BANDAGE OF BOTH BREASTS.

This bandage is used to support both breasts. The roller should be from ten to twelve yards long and two and a half inches wide.

Place the initial extremity of the roller behind the right axilla, crossing the back; carry the bandage over the left shoulder, pass obliquely across the front of the chest, under the right breast, and under the right axilla to the point of departure. Make two or three oblique turns of the neck and axilla, covering in the breast by the gradual ascent of each turn, and on reaching the back of the right axilla in the third turn, pass transversely across the back to the left axilla; under this and across the chest in front of the left breast to the right side of the neck; then across the back to the left axilla. Repeat two obliques of the neck and left axilla, and on reaching the front of the left armpit pass transversely under both breasts to the right axilla, from thence to the point of departure, care being taken that each revolution covers successively the breasts from below upward.

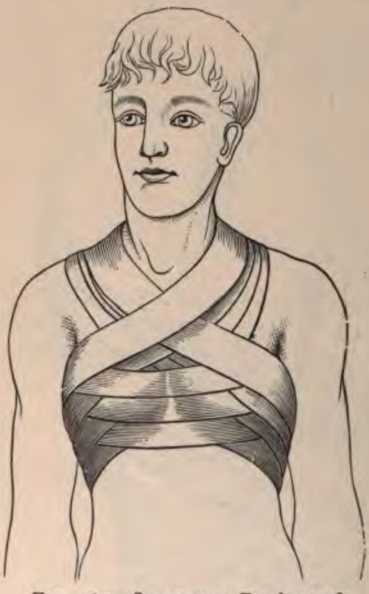


FIG. 165.—Suspensory Bandage of Both Breasts.

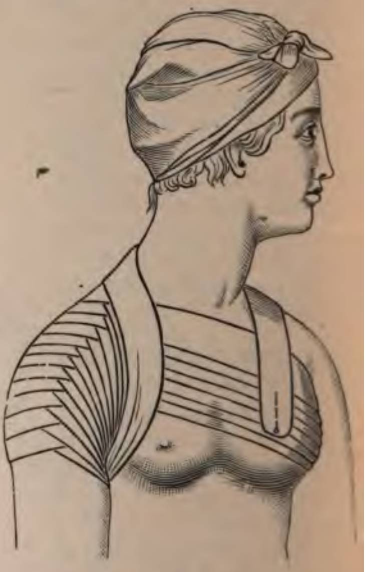


FIG. 166.—Spica Bandage of the Shoulder.

SPICA BANDAGE OF THE SHOULDER.

This bandage is used in dislocations of the humeral extremity of the clavicle, or to retain the head of the humerus in place after dislocation has been reduced. Length of roller eight yards; width two and a half inches.

Make three spiral reversed turns around the upper part of the arm of the injured side, passing from without inward and from before backward; pass from thence from behind the arm up over the lower extremity of the shoulder, then obliquely downward over the front of the chest to the axilla of the sound side; thence around the back obliquely upward over the shoulder, and down in front under the axilla of the injured side, taking care to use some cotton batting or a compress to protect the point of injury. From this point go behind and over the shoulder, pursuing the same course as before, each turn covering in one-third of the preceding turn until the bandage is sufficiently exhausted to be made to terminate by one or two circulars of the trunk.

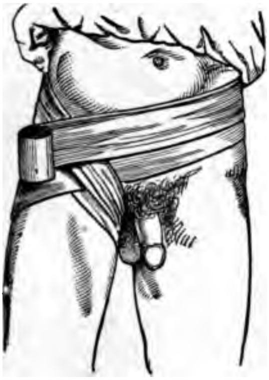


FIG. 167.—Spica Bandage of the Groin, Retaining Pad.

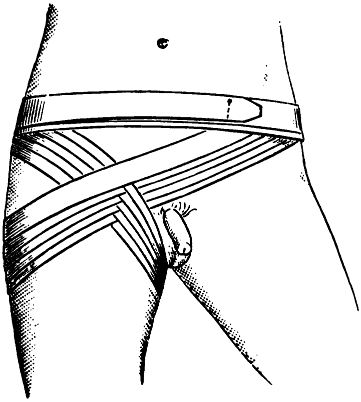


FIG. 168.—Spica Bandage of Groin.

SPICA BANDAGE OF THE GROIN.

Requires a roller eight to ten yards long and three inches wide. This may be done in one of two ways. 1st Method: The bandage is to be carried along the lower part of the groin of the affected side, from within outward, over a pad, if necessary; then pass around the pelvis, and back over the pubes, crossing the former fold of the groin, completing the figure-of-eight. A series of such turns, each slightly overlapping the other, must be repeated until the part is covered, and a sufficient amount of compression is produced.

2d Method: Place the initial extremity of the bandage above one of the iliac crests, make two horizontal circular turns around the pelvis, so as to fix the front of the bandage, turn from right to left, and from before backward, if for the right groin; and the reverse if for the left.

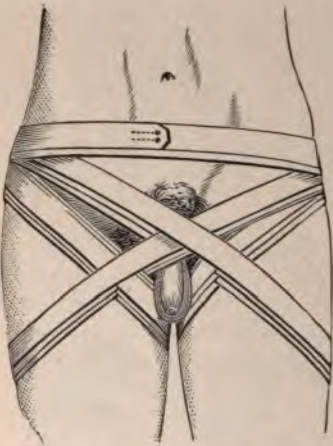


FIG. 169.—Double Spica Bandage of Groins.

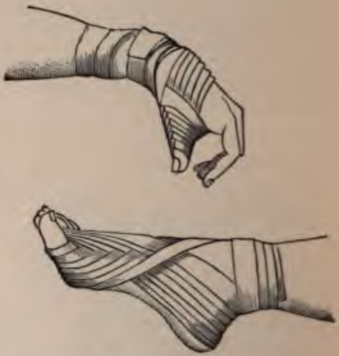


FIG. 170.—Spiral of Toe or Finger.

Arriving in front of one of the groins descend to the inner side of the thigh, between it and the genital organs, and winding around the back part ascend on the outer side so as to cross the first turn; from thence to the iliac bone of the opposite side, across the back and around the pelvis to follow the same course,

DOUBLE SPICA FOR BOTH GROINS.

A roller twelve yards long and three inches wide is required. First, make two horizontal turns about the pelvis; upon arriving at the second turn, near the groin—the left, for instance—turn the roller so that it will pass obliquely downward along the outer side of the thigh, and ascend ng its inside so as to cross the first descending turn; it is then conducted around the back of the pelvis as far as the right groin, and made to pass along the inner side of the right thigh; remounting on its outer side, and carried again around the pelvis in front, and to the left. The bandage pursues this course until a sufficient quantity of the bandage remains to terminate by two horizontal turns of the pelvis.

TO BANDAGE THE PERINEUM AND PUBES.

A roller six yards long and three inches wide is required for this bandage.

After a turn around the body, the bandage passes obliquely down across the left groin, then behind the left thigh, just below the fold of the nates, and obliquely upward, across the perineum, and through the right groin toward the right iliac spine. It then passes round the body behind, and from the left iliac spine obliquely downward, along the left groin, to cross the perineum, and go below the genital fold on the right thigh, and so around the body again.

BANDAGES OF EXTREMITIES.

SPIRAL, OF ONE FINGER.

Bandage four feet long and one inch wide required. Fix the initial extremity around the wrist by two or three circular turns; cross the back of the hand so as to descend either finger to its extremity, which is then bandaged downward to the root, by ordinary spiral reversals, and terminates by a few turns around the wrist.

SPIRAL, OF ALL THE FINGERS.

This bandage should be eight yards long and one inch wide. Begin by one or two circulars around the wrist; pass obliquely over the back of the hand, and descend by oblique turns to the end of the forefinger, then ascend, by reverse turns, to its base; then pass to the middle finger, ascend and descend, as in the case of the forefinger, continuing until all the fingers are covered in. Then pass to the back of the hand, or front if preferred, and finish by circulars around the wrist.

THE GAUNTLET, OR SPIRAL FOR ALL THE FINGERS.

Roller should be eight yards long and one inch wide.

Commence with two circulars around the wrist; pass obliquely over the back of the hand; descend, by oblique turns, to the nail of the forefinger, then ascend by reversed turns to the base; descend, by oblique turns, to the nail of the middle finger, ascend by spirals to the base, and continue this until all the fingers are covered. From the base of the little finger pass in front of the hand, finishing by circulars around the hand and wrist.

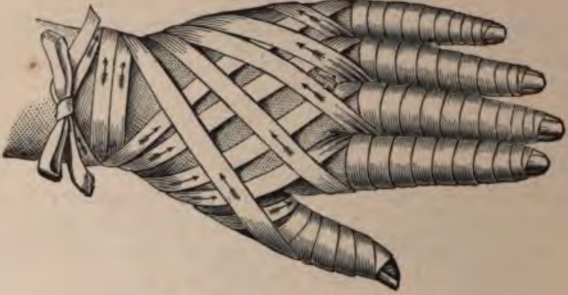


FIG. 171.—Spiral of Fingers.

THE DEMI-GAUNTLET.

Make a couple of turns around the wrist; cross the back or palm of the hand by oblique turns, which will pass between each finger; then make a circular turn around the wrist.

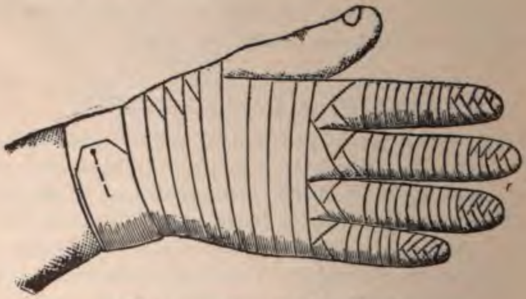


FIG. 172.—Gauntlet for Hand.

SPICA OF THE THUMB.

The roller should be three yards long and one inch wide.

Begin by two circular turns around the wrist, from thence cross the *base of* the thumb to the phalangeal articulation; around the thumb, thence to the wrist, and so continue, taking care to cover one-half of each preceding turn until the thumb is covered, and terminate by a couple of turns around the wrist.

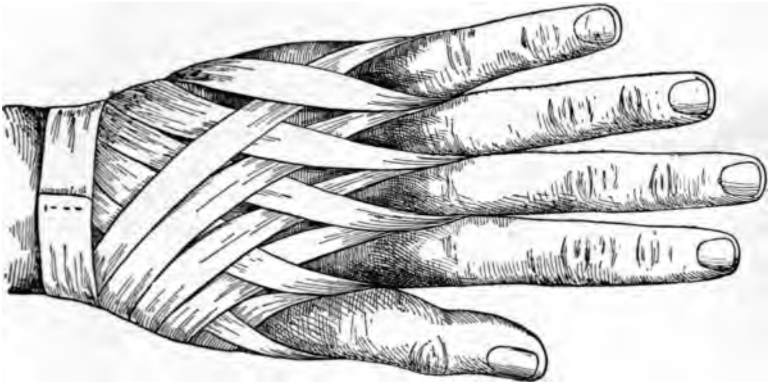


FIG. 173.—Demi-Gauntlet.

BANDAGES OF THE ARM.

FIGURE-OF-8 OF THE WRIST.

Roller should be two yards long by two inches wide. Take two circular turns around the wrist, commencing on either the dorsal or palmar surface; when reaching the latter side, turn obliquely across to the space between the thumb and forefinger—for instance, of the right hand; from thence obliquely over the palm to a corresponding point on the metacarpal bone of the little finger; from thence obliquely across the back of the hand to the wrist joint; now make a semi-

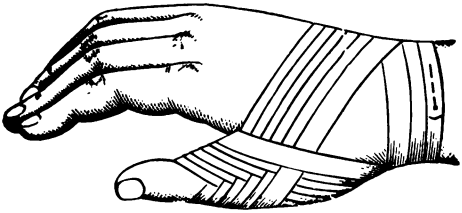


FIG. 174.—Spica of Thumb.

horizontal turn around the wrist to the ulnar side. Repeat same course over again, terminating with a turn around the wrist.

FIGURE-OF-8 OF THE ELBOW.

The roller should be two yards long, and two and a half inches wide.

Begin at the external and upper part of the forearm; pass obliquely over the bend of the arm to the internal tuberosity of the humerus, and carry it on around the olecranon to the external tuberosity; from thence obliquely over the front, crossing the first turn, to the inner and upper part of the forearm, and then across the back, to the point of departure, to go over the same course.

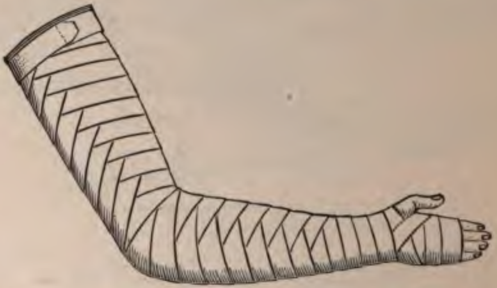


FIG. 175.—Spiral Reverse of the Upper Extremity.

SPIRAL REVERSE OF THE UPPER EXTREMITY.

The roller should be eight yards long, and two and a half inches wide.

Begin with two circular turns around the wrist; from thence pass obliquely over the back and palm of the hand to the fingers; ascend by spiral turns until the phalangeal metacarpal joint of the thumb is reached; cover this and the wrist joint by a figure-of-8; ascend the limb, by simple and reverse turns, until the elbow is reached. If the arm is to be flexed, cover the elbow with figure-of-8; if not, employ spiral turns without reversing, and continue the spiral and reverse turns to the shoulder, using such compresses, etc., as may be necessary.

BANDAGES OF THE LOWER EXTREMITY.

FIGURE-OF-8 OF THE ANKLE.

The roller should be from two to three yards long and two and a half inches wide.

Take two turns around the leg above the malleoli, then go obliquely downward in front of the ankle to the side of the foot, from thence under the sole of the foot to the opposite side, pass obliquely upward in front of the ankle to the beginning, ending with as many turns around the ankle as may be necessary.

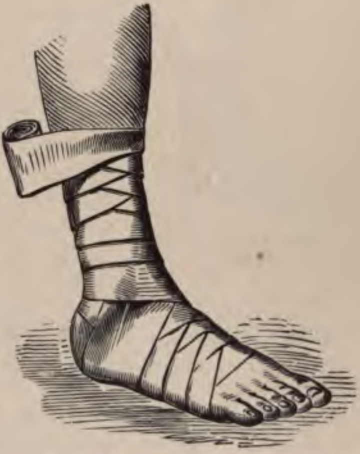


Fig. 176.—Figure of Eight of Ankle.

FIGURE-OF-8 BANDAGE OF THE KNEE.

The roller should be two yards long and two and a half inches wide.

Commence at the upper part of the leg, below the knee, making one or two circular turns; pass obliquely upward across either the patella in front or over the back of the knee to the lower part of the thigh, then pass around the thigh and come from the opposite side of the thigh obliquely downward across the front or back of the knee to the side of the leg, repeating as many time as may be necessary.

FIGURE-OF-8 OF THE THIGHS.

Roller should be from four to six yards in length and three inches wide.

Make two circular turns above the knees, then carry the bandage obliquely over the lower part of the thigh, carry it around until it reaches the outer side of the opposite limb, and bring it down to point of departure, making as many figure-of-8 turns as may be necessary, and terminating with circular turns around the upper part of the thigh.

SPICA BANDAGE OF THE INSTEP.

The roller should be from six to eight yards long and two and a half inches wide.

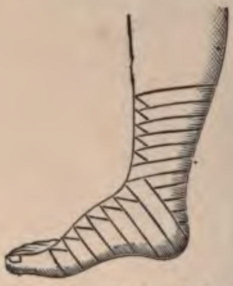


FIG. 177.—Spica of Instep.

Begin at the tarsal end of the metatarsal bone. Pass over the front of the foot to the first joint of the big toe if the right, or that of the little toe, if the left foot; pass under the sole to the outer or inner side, depending whether it is the right or left foot. Then make two obliques over the front of the foot, when the instep will be reached; from thence pass to the point of the heel in a line parallel with the sole; then pass around the heel, to again come to the instep, keeping parallel to the sole; cross the instep and make another similar turn, which must cover the heel and instep. Then cover over one-third of the preceding turn, and form a spica on the instep. These turns must be continued till the foot is completely covered; the bandage to be continued by circulars or spirals on the leg.

SPIRAL-REVERSE BANDAGE OF LOWER EXTREMITY.

The roller should be twelve yards long and two and a half inches wide.

Begin with a circular bandage at the metatarso-phalangeal articulation, take two turns, and ascend by reverse turns well up on the instep; from thence go over the point of the heel back to the instep, under the heel, around the side of the heel, and back of the heel up to the instep, under the sole of the heel over the opposite side of the heel, thence around the back of the heel to the instep; then make figure-of-8 turns of the ankle, spiral turns over the joint; spiral reverse turns to the knee; figure-of-8 turns to the knee; spiral turns over the knee joint, and ascend the thigh to the hip by spiral-reverse turns, and finish by circular turns around the upper part of the thigh.

HANDKERCHIEF SYSTEM.

Mayor's handkerchief system for temporary or provisional dressing has been in vogue for the last fifty years, and is in general use.

The ordinary handkerchief or square piece of silk, cotton, or linen, folded into various shapes to suit the object indicated, is used to *replace* the ordinary bandage or roller.

The handkerchief may be made *oblong, cravat-shaped, triangular,* or *cordi-form,* to meet the necessities of the case.

It is obviously impossible to give the whole of the system of Mayor in a book of this kind; a few of the principal bandages are reproduced, that the student may understand something of the method recommended by its originator.

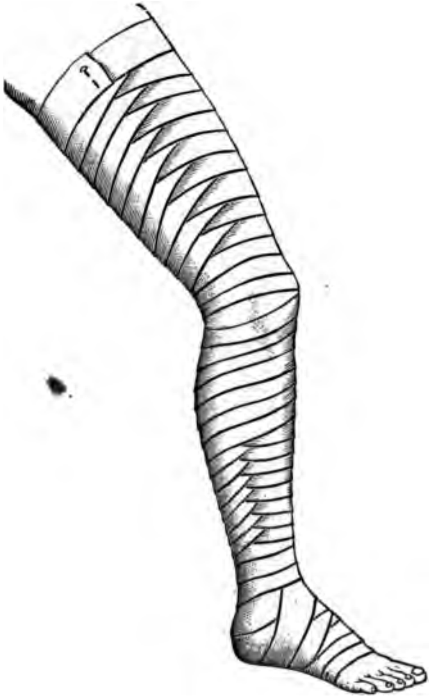


FIG. 178.—Spiral Reverse of Lower Extremity.

THE SQUARE CAP OF THE HEAD.

Having folded the handkerchief into an oblong square, and allowed the edge of the handkerchief that is to rest next to the head to be two inches shorter than the other, the ends of the long side are to be drawn to the side of the face and tied under the chin, the inner ends or those of the short side must be drawn so as to free them from the first; folding this part backward, the ends must be tied on the occiput.

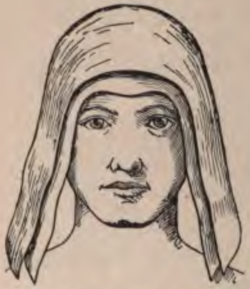


FIG. 179.—Square Cap of Head, first step.

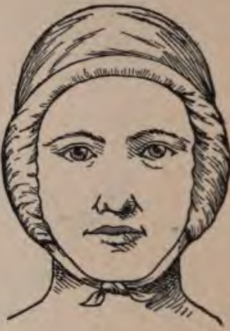


FIG. 180.—Square Cap of Head, completed.

BIS-AXILLARY CRAVAT.

Place the centre in the axilla of the affected side, cross the tails over the corresponding shoulder, and then carry them one before and the other around and behind the chest to the axilla of the opposite side, where they are to be secured.

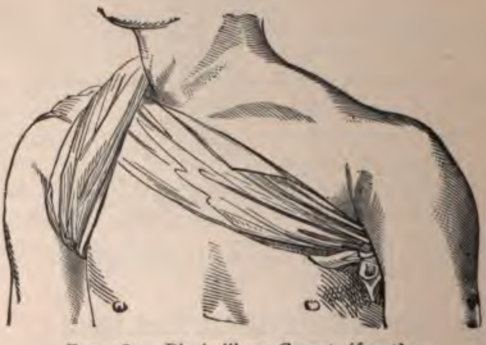


FIG. 181.—Bis-Axillary Cravat (front).

COMPOUND BIS-AXILLO-SCAPULARY CRAVAT.

Knot together the two ends of a cravat on one of the shoulders, so as to make a loose ring, then take a second cravat; apply the centre of this against the anterior face of the other shoulder, carry the tails of one over the shoulder and of the other beneath the axilla. The first must embrace the corresponding portion of the ring, so that its extremity may be united with that of the second tail, which should be made to pass about the first.

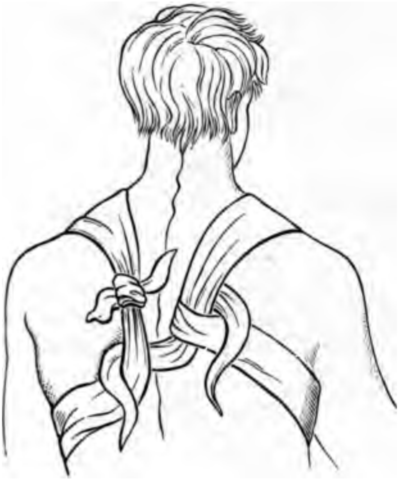


FIG. 182.—Bis-Axillary Cravat (back).

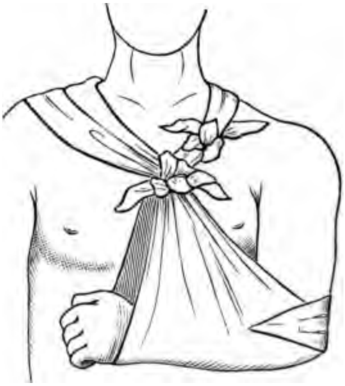


FIG. 183.—Cervico-brachial Sling.

THE CERVICO-BRACHIAL SLING.

This bandage is made by placing one handkerchief around the neck and knotting its ends over the sternum. The other is to be placed in triangular form under the forearm, so that its base may be next to the wrist. Its angles are then to be tied to the handkerchief around the neck. The summit is to be carried around the elbow to fasten to the body of the triangle in front.

SPECIAL BANDAGES.

ESMARCH'S BANDAGE

consists of three yards of red elastic or india-rubber bandage and four feet of rubber tubing, with hook and chain. The elastic bandage is two and a half inches wide.

The bandage is used to empty the limb of its blood by rolling the india-rubber bandage from below upward to the spot where the blood is to be controlled. At this point the india-rubber tube is passed around the limb, sufficiently tight to stop the circulation in the vessels; the ends of the tube are then worked into each other.

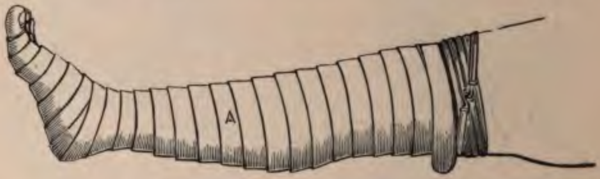


FIG. 184.—Esmarch's Bandage.

The india-rubber bandage is then removed, and the limb will remain bloodless until the tube is taken off.

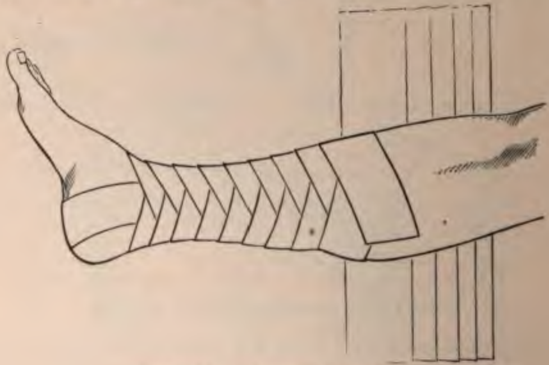


FIG. 185.—Scultetus Bandage.

BANDAGE OF SCULTETUS

consists of a number of strips about three inches wide, and of a length *gradually* increasing from the first strip, which should be long enough to go one and a third times around the upper part of the limb. They are arranged in such a manner that, when applied, each succeeding one shall overlap from one-third to one-half of the preceding one, the compression being made in a gentle, uniform manner. It is generally used in the treatment of compound fractures and dislocations.

THE BANDAGE OF VELPEAU.

The roller should be ten yards long and two and a half inches wide. The patient having placed the hand of the injured side on the sound shoulder, and a compress having been inserted between the side of the chest and injured side so as to prevent excoriation, the initial extremity of the roller is laid under or behind the axilla of the sound side; from thence it is carried over the back, over the injured clavicle, down on the front and *outside* of the arm, under the *outside* of the elbow, and over the chest to the sound axilla. Make two similar turns, and on again reaching the axilla, pass circulars around the chest to the same axilla; then make a turn over the clavicle and arm; then a circular, continuing until it reaches the upper part of the forearm.

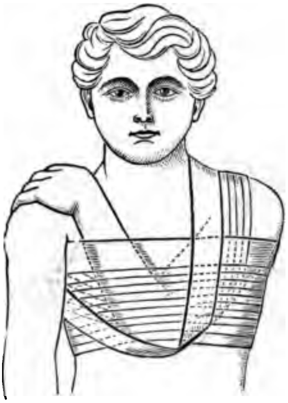


FIG. 186.—Velpeau's Bandage.

When a permanent dressing is needed, starch, dextrine, silicate of soda, or plaster-of-Paris should be applied to this bandage, and thus a firm cap will support the arm.

DESAULT'S APPARATUS.

There is required for this apparatus three single-headed rollers, each eight yards long and two and a half inches wide, a triangular wedge-shaped pad to place in the axilla, and measure four inches in width at its base and of sufficient length to reach to the elbow; a compress to cover the seat of fracture, and a sling to support the hand.

The pad is placed in the axilla, the thick end upward, where it is firmly held by an assistant. The initial end of the first roller is then placed on the middle of the pad, and at least three circular turns of the chest made, when the roller must be carried up over the front of the chest, over the sound shoulder, under the armpit, so as to make a semicircular turn on the front of the chest, then over the pad, around the back, over the shoulder, under the armpit, and then around the chest.

The forearm must now be flexed upon the arm, pressing the latter against the pad, and at the same time the shoulder be forced upward and backward.

The initial end of the second roller should be placed in the axilla of the sound side, carried across the breast, over the upper part of the arm of the injured side, and obliquely around the back to the axilla, from place of beginning, and these turns should be continued around the arm, descending to the upper part of the forearm.

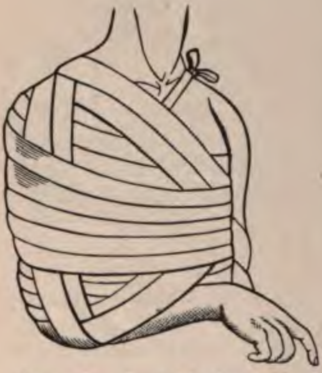


FIG. 187.—Desault's Bandage.

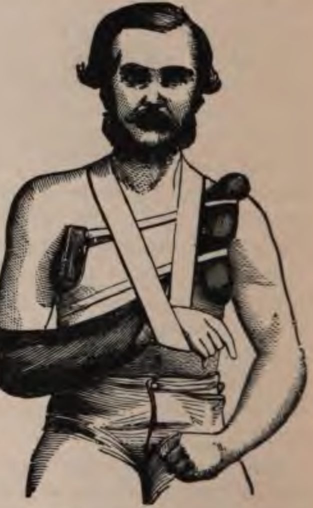


FIG. 188.—Fox's Apparatus for Fracture of Clavicle.

The initial end of the third roller is then placed in the sound axilla, passed over the front of the chest obliquely to the seat of fracture, where there must be placed a compress, over this and down the back of the arm to the elbow; thence obliquely upward to the front of the sound axilla; under this obliquely upward over the back, over the fracture, down the front of the arm to the elbow, and thence obliquely *to the* back; then to the sound axilla, under this to its front part and over the chest and fractured bone, to run the same course, and end by circulars of the chest so as to fix the whole.

Summary of the Third Roller.—Axilla to shoulder; shoulder to elbow; elbow to axilla.

The forearm must be supported by a sling.

FOX'S APPARATUS FOR FRACTURED CLAVICLE.

Fox's apparatus is a ring, a sling, and a pad. The ring is placed on the sound shoulder; the sling is made to fit the elbow of the arm belonging to the fractured clavicle; it must extend to the wrist; it is tied to the ring by two slips of girthing forward and two back, and, in addition, one tape is attached to the lower and back part of the sling, to draw the arm back.

SAYRE'S DRESSING FOR FRACTURED CLAVICLE

consists of adhesive strips. They are applied by forming a loop over the *upper* part of the injured arm; it must fit loosely. Put the arm in position, draw the strip around the body over the back, let an assistant hold it while the fragment is manipulated, then draw it tightly and secure it to the chest, thus carrying the shoulder back. Place a second

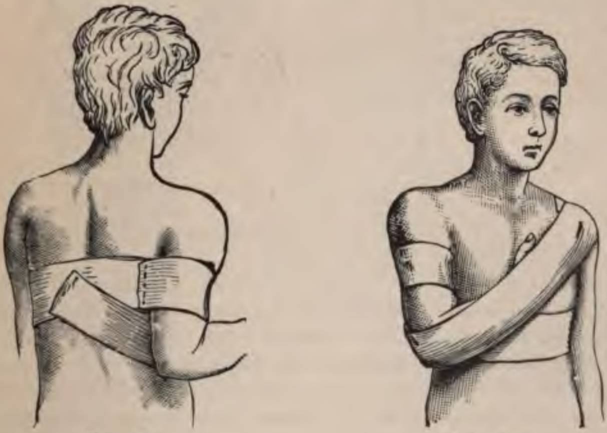


FIG. 189. FIG. 190.

Sayre's Dressing. (*Agnew.*)

strip under the elbow, and both ends over the opposite shoulder, the centre to be against the olecranon.

THE RECURRENT BANDAGE FOR STUMP.

The roller should be about six yards long and two inches wide.

First make three circular turns around the stump, about three or four inches above the extremity; then place the thumb over the middle of the turns in front, and the forefinger behind; bring the bandage directly over the face of the stump, from the middle line in front to the same point behind. Keep the reverse in place behind by the forefinger, and bring the bandage back again, a little to the one side of the middle, converging when it reaches the starting point. Fix this by the thumb, bring the bandage over again, passing now to the other side of the middle line and converging to it behind. Continue these reverses till the whole stump is covered, then by one or two firm circular turns fix them in position, in which they are held by the thumb and finger.

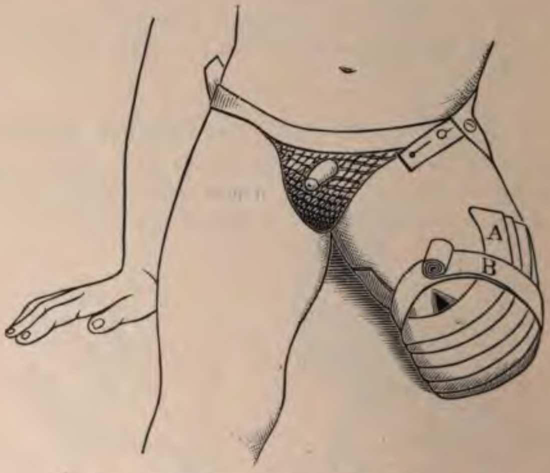


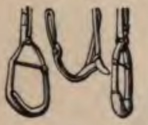
FIG. 191.—Recurrent Bandage for Sling.

SAYRE'S PLASTER JACKET.

Articles needed.—Freshly-burned plaster-of-Paris; knitted, elastic, woolen "skin-fitting vest"; two-, three- and four-inch wide rollers of crinoline, or cross-barred muslin, three yards long; cotton, wool and felt; two silk pocket-handkerchiefs; Sayre's triangle, with pulleys, head collar and arm-loops; two basins of cold water, deep enough to submerge the rollers when set up on end, strips of thin tin plate, half-inch wide, and punched with holes to roughen their surfaces; safety pins, needle and thread; towels; black-lead pencil.

In addition to the foregoing, Welsh flannel rollers and thick, soft felt are frequently required to protect the skin overlying bony projections from being chafed under the plaster case, and an apron to protect the operator's clothes.

FIG. 192.



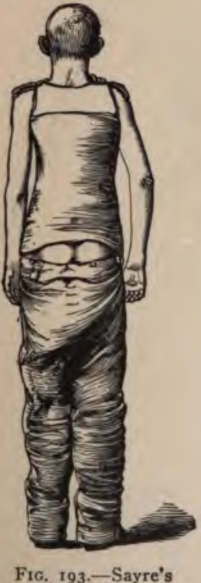


FIG. 193.—Sayre's Plaster Jacket Applied.

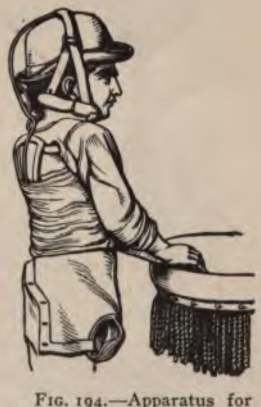


FIG. 194.—Apparatus for Disease of Cervical or Upper Dorsal Spine.

1. Prepare from six to twelve rollers, according to the size of the patient, by gradually unrolling them on a table, while some one rubs in the powder and another person rolls the loaded bandage up loosely.

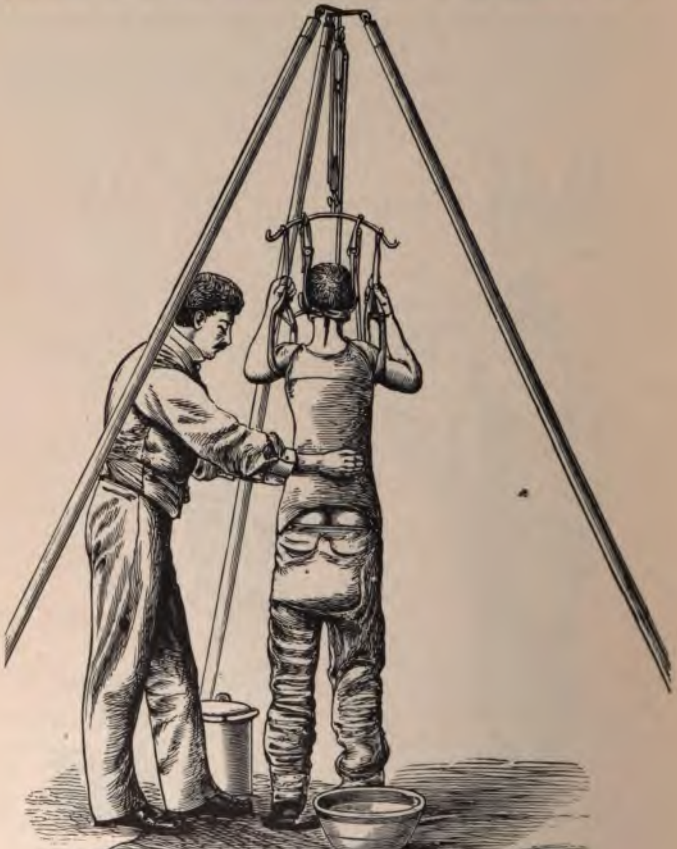


FIG. 195.—Application of Sayre's Plaster Jacket.

2. Erect the suspending triangle, and set ready the basins of water, *bandages, pins,* and other articles.

3. The body should now be thoroughly washed and dried and the "skin-fitting" shirt put on. Then beneath the shirt and next to the skin a pad of cotton wool, folded in a silk handkerchief, is slipped up in front, leaving the ends of the handkerchief hanging below the shirt. The object of this pad is to preserve a slight concavity over the pit of the stomach and navel after the plaster has set; it is termed the "dinner pad." In females two small pads should overlie the breasts. When the pad is put on, fasten the shirt down in front and behind with safety pins, to a folded towel pressed between the thighs. A towel should be wrapped around the patient's legs to protect the dress from the water or plaster. The level of the armpits, while the arms hang down, is then marked in pencil across the back and front of the shirt.

4. Arrange the patient in the suspending triangle, and let him draw himself up until his weight is supported; the tips of the toes should rest on the ground to keep steady the body. The patient must support himself by pulling the cord just so much as feels comfortable to him, and no more.

Now begin the bandaging. An assistant plunges into water a roller, so that, as it stands on end in the basin, the roller is covered with water; as soon as bubbles cease to rise from the roller it is ready for the assistant to hand to the operator; as he does so he squeezes out the excess of water and puts in another roller to soak. The operator, standing in front of the patient, rapidly rolls on the bandage, beginning at the top, where the pencil mark shows the level of the armpits; above this line the bandage must not be carried.

The assistant watches the progress of the bandage behind the patient, smoothing down the turns as they are applied, that they may fit closely to the patient's body, and wetting any part of the bandage that the water may not have reached during immersion. Bandage after bandage is then laid on the trunk, taking care to carry the lower turns well below the hips, just avoiding the pubes and great trochanters.

When the trunk is wrapped in one layer of bandage, strips of tin plate, long enough to reach nearly from the upper border to the lower one, are laid along each vertebral groove and below each armpit; these are sufficiently supple to bend readily to the shape of the body, but give the case rigidity where it is likely to be strained by the weight of the patient's head and shoulders. As the straps are applied by the assistant the surgeon covers them with a roller. When about three thicknesses of bandage are applied the jacket is thick enough in ordinary cases.

The "dinner pad" must now be withdrawn, the patient laid on a flat couch, which has been placed close to him, so that the soft plaster case may not be strained before it has hardened. The operator, while the patient lies flat, moulds the jacket about the hips and groins by gentle pressure of the hands. The patient is then covered with a light shawl for half an hour till the plaster has set.

THE JURY MAST.

When the disease in the spine is above the lower dorsal region, the jacket cannot be carried high enough to prevent the forward pressure at the diseased part. To meet this condition an iron support is attached to the plaster jacket while the bandage is being applied. From this support a steel rod rises behind the neck and head, and ends immediately above the vertex. A cross bar turning horizontally projects across the head. From this the head is slung in a jaw bandage, and thus the weight of the head is lifted off the diseased spinal column.

PERMANENT DRESSINGS.

The most reliable bandages for permanent dressings are: the plaster-of-Paris, silicate of sodium or silicate of potassium, paraffin, and the starch bandage, which is now seldom used.

The plaster-of-Paris bandage is prepared by rubbing dry plaster, of the finest quality, and freshly calcined, thoroughly into the meshes of a thick, coarse muslin or crinoline roller, which if not required for immediate use, is loosely rolled and kept in a dry place until it is needed, when it is soaked for a few minutes in cold water. The limb, first carefully enveloped in flannel, wadding, or old linen, is then surrounded by the bandage; three or four rollers generally answer the purpose.

The silicate of sodium, or potassium in a saturated solution, applied with a stout brush, is the "glass dressing" of surgeons. When well rubbed into the meshes of a wet roller, a firm and immovable apparatus is formed, in no way inferior to the plaster-of-Paris. The glass dressing dries very rapidly, does not irritate the skin, and is easily procured. From three to five layers of bandage are necessary to ensure the requisite amount of stiffness. Sometimes a binder's board will be required to impart sufficient support.

Paraffin is frequently used as a fracture dressing. After being thoroughly melted, it is partially cooled to render it more viscid; then it is rubbed thoroughly into the meshes of the bandage with a coarse paint-brush, when a neat light dressing is formed, impermeable to water, pus and other fluids, and every way adapted to the treatment of compound fractures.

The *glue* dressing is prepared by rubbing warm glue into the bandage. Before being used it must be diluted with a fifth part its bulk of alcohol, or a small quantity of oxide of zinc, to promote desiccation.

When applied in the usual manner the mixture at once begins to harden, but it does not become thoroughly dry for several hours. Wadding should be placed next to the skin, and then two or three layers of bandage must be applied. Should additional strength be needed, fresh strips of linen may be glued on, without changing the original dressing.

The *starch bandage* is now seldom used; it is applied like the glue bandage by rubbing starch into the interstices of ordinary rollers. Four and sometimes five thicknesses are required to insure sufficient support. It may be necessary to place strips of pasteboard, which have been soaked in starch, on the sides of the limb.

FORMULÆ.

SELECTED FROM STANDARD AUTHORITIES, AND FROM THOSE IN USE IN THE PRACTICE OF THE AUTHOR.

GONORRHŒA.

1. ℞. Sodæ bicarb.,
Sodæ bromid., } aa ʒ iv
Tr. belladon., ʒ j
Ext. pareiræ fld., fʒ vj
Aq. menth. pip.,
Syr. acaciæ, } aa fʒ iij.

Ft. M. Tablespoonful every three hours, to be used during the first days of gonorrhœa.

2. ℞. Methylene blue gr. xxiv
Ft. capsules, no. xxiv
Sig. one t. i. d. after meals.

To be used in the first stages of gonorrhœa.

3. ℞. Potass. chlorat., ʒ ij
Aq. bullient., f℥ v
Misce et adde liq.
potass., fʒ iij
Potass. acetat., ʒ iv.

M. Two tablespoonfuls three times daily for the first few days.

4. ℞. Copaibæ, ℥ j
Liq. potass., ʒ ij
Ext. glycyrrhiz. co., ʒ ss
Spir. ether. nit., ℥ j
Mucilag. acaciæ, ℥ vj
Ol. gaultheriæ, gtt. xvj.

M. A tablepoonful three times a *day.*

5. ℞. Mucilag. acaciæ, ℥ v
Vin. opii, ℥ j
Ol. juniperi,
Ol. cubebæ, } aa ʒ ij
Copaibæ, ʒ iij
Spir. gaultheriæ, ℥ j.

M. A teaspoonful four times daily.

6. ℞. Pulv. alum., ʒ iv
Pulv. cubebæ, ℥ iv.

M. Tablespoonful in a wineglassful of water, three times daily.

7. ℞. Copaibæ, ℥ ss
Spir. ether. nit., f℥ ss
Pulv. acaciæ, ʒ ij
Sacchari, ʒ j
Aq. destil., f℥ iv
Spir. lavend. co., ʒ ij
Tinc. opii, fʒ j.

Ft. Mist. Tablespoonful three times daily.

8. ℞. Tinc. belladonnæ, fʒ ss
Sodæ bromidi, ʒ iv
Liquoris potass., fʒ i
Tinct. opii camph., f℥ i
Syrupus zingiberis, f℥ iii
Aquæ destillat.,
q. s., ad f℥ vi.

Ft. Mist.

Signa. Tablespoonful in water after meals.

Used where complications arise to quiet the genito-spinal centers and urinary tract.

CAPSULE C. C. AND S.

9. ℞. Salol, gr. x
Oleoresinæ cubebæ, gr. v
Para balsam copaibæ, gr. x
Pepsinæ, gr. j.
Ft. capsule, no. 1.
M. One three times a day after meals.

INJECTIONS IN GONORRHŒA.

10. ℞. Zinci sulph., gr. xv
Plumbi acet., gr. xxx
Tr. catechu, }
Vin. opii, } aa fʒj
Aq. rosæ, f℥vj.
M. Use as injection night and morning.

---

11. ℞. Plumbi acet., gr. xxx
Zinci sulph., gr. xv
Hydrastin sulph., gr. xij
Ext. ergot. fld., fʒiv
Tr. opii, fʒiij
Aquæ, f℥vj.
M. Shake well and use as injection.

---

12. ℞. Hydrarg. chlor. corrosiv., gr. ss
Aquæ destil., ℥vj.
M. Use as injection.

---

13. ℞. Acid borici, gr. ijss
Aquæ camph., ℥j
M. Use as injection.

---

14. ℞. Zinci sulph., gr. xvj
Plumb. acet., ʒss
Hydrastin (Lloyd's), }
Bismuth. subnit., } āā ʒiv
Tannin, glycerol, }
Mucilag. acaciæ, ℥ij
Aq. dest. q. s. ut ft. ℥vj.
M. Shake well and inject night and morning.

15. ℞ Argyrol 10 % sol. f℥iii
Sig. Inject three times a day. To be used in early stages of gonorrhœa and later followed by
℞. Protargol ½ % sol. f℥iii
Sig. Inject three times per day.

GONORRHŒA IN THE FEMALE.

16. ℞. Plumbi acet., }
Zinci sulph., }
Alum pulv., } āā ʒiij
Tannin, }
Aqua, Oj.
M. Vaginal injection.

VAGINAL SUPPOSITORY IN THE CONVALESCENT STAGE OF GONORRHŒA.

17. ℞. Alum pulv., }
Plumb. subac. cerat., } āā ʒiij
Ol. theobromæ, q. s.
Ft. suppository no. 12.
Use one night and morning.

CHILBLAINS.

18. ℞. Liniment. camphor., }
Liniment. saponis, } āā ℥j.
Cajeput. ol., }
M. S. Use locally on the unbroken skin.

---

19. ℞. Acid carbol., gr. x
Vaseline, }
Ol. terebin., } āā ℥j.
M. S. Spread over the affected surface.

CHORDEE.

20. ℞. Pulv. opii, gr. ij
Camphoræ, gr. iv
Lupulin, gr. xv.
Ol. theobromæ q. s.
M. Ft. suppository. Pass into the bowel at night.

SWELLED TESTICLE (SUB-ACUTE).

21. ℞. Iodoform,
Ext. belladon.,
Ung. hydrarg., } āā ʒ j
Ung. zinci ox., q. s. ut fiat, ℥ j.
M. To be used locally.

ACUTE CYSTITIS.

22. ℞. Belladon. succi, gtt. xx
Sodæ boras, ʒ ij
Acid benzoic, gr. xx
Tr. opii camph., ℥ iss
Ol. gaulther., gtt. xij
Syrup. simp., ℥ ij
Aq. destil., ℥ iv.
M. S. Tablespoon in water four times daily.

---

23. ℞. Potass. bicarb., ℥ j
Tr. hyoscyam.,
Kavæ kavæ ext. fld., } āā ℥ ss
M. Tablespoonful in a wineglassful of water, three times daily.

---

24. ℞. Lupulin ℥ j
Uvæ. ursi. fol., ℥ ij
Aq. bullien., Oj
M., and add, when cool,
Tr. opii camph., ℥ ij
Sodii bicarb., ʒ ij.
M. Tablespoonful four times daily.

---

25. ℞. Lupulin, ʒ j
Tr. belladon., f ʒ ss
Tr. opii camph., f ℥ ij
Sodii bicarb., ʒ j
Inf. buchu q. s. ut ft. f ℥ vj.
M. Tablespoonful in water three times daily.

---

26. ℞. Tr. belladonnæ, f ʒ ss
Sodium bromide, ʒ iv
Sanmetto, f ʒ xii
Syrup ginger, f ℥ iii
Distilled water q. s. ad., f ℥ vi.
M. et sig. Tablespoonful t. i. d., after meals.

Used in acute cystitis to quiet spasm.

GARGLES.

27. ℞. Acid tannic, ʒ ij
Spir. vin. rect., ℥ j
Mistura camphoræ, f ℥ x.
M. Gargle.

---

28. ℞. Potass. chlor., ʒ j
Tr. cinchon. comp.,
Tr. guaiaci ammon., } āā ʒ ij
Mel dest., ℥ j
Aquæ q. s. ut ft. ℥ iv.
M. Ft. Gargle.

---

29. ℞. Potass. chlor., ʒ iss
Tr. ferri chlor., ʒ iij
Listerin., f ℥ iv.
M. Pour half an ounce in half a glass of water, and use as a gargle.

---

30. ℞. Potass. chlor., ʒ ij
Listerin., ℥ j
Ol. gaultheriæ, gtt. vj
Syr. simp., ℥ j
Aquæ destil., ℥ ij.
M. Gargle.

MOUTH-WASH FOR MUCOUS PATCHES.

31. ℞. Acid. pyrolig., ʒ j
Aquæ, ℥ viij.
M. Wash mouth every four hours.

---

32. ℞. Tinct. myrrh, ℥ ss
Potass. chlor., ʒ iij
Aquæ, f ℥ iv.
M. Wash mouth every three or four hours.

---

33. ℞. Acid tannic, ℈ i
Acid boric, ʒ ii
Honey of rose, f ℥ i
Distilled water q. s. ad., f ℥ vi
M. et sig. Wash mouth three or four times a day.

Stimulating Lotions and Ointments to Apply to Granulating Surfaces and Ulcers.

34. ℞. Cerat. resin. co., ʒ j
Balsam Peruvian, ʒ ij
Iodoform, ʒ j
Ung. petrolei, ℥ j.
M. Use locally.

35. ℞. Ung. hydrarg. nit., ʒ j
Pulv. jalapæ, ʒ ij
Balsam Peruvian, ʒ j
Ung. zinc. ox., ℥ j.
M. ft. ung. Use locally.

36. ℞. Ung. hydrarg. nit., ʒ j
Cosmolin, ℥ j.
M. ft. ung. Use locally.

37. ℞. Acid chromic, gr. v
Distilled water, f ℥ ss.
Sig. Apply to mucous patches with brush once daily.

LOTIONS.

38. ℞. Cupri sulph., gr. iv
Aquæ, ℥ j.
M. Use locally.

39. ℞. Argent. nit., gr. ij
Aquæ destil., ℥ j.
M. Use locally.

40. ℞. Acid nitric, gtt. ij
Aquæ, ℥ j.
M. Use locally.

RED WASH.

41. ℞. Zinc. sulph., gr. x
Spir. rosmarin.,
Tr. lavend. co., āā ʒ iss
Aquæ, f ℥ x.
M. Use locally.

YELLOW WASH.

42. ℞. Hydrarg. chlor. cor., gr. j
Liquor calcis, f ℥ j.
M. Use locally.

BLACK WASH.

43. ℞. Hydrarg. chlor. mit., ʒ j
Liquor calcis, f ℥ iv.
M. Bottle to be well shaken before using.

44. ℞. Tannin, gr. iij
Ex. opii aq., gr. ij
Cupri sulph., gr. ⅛
M. Use locally.

SYPHILIS.

45. ℞. Mass hydrarg.,
Ferri sulph., aa ℈ j
Pulv. opii, gr. x
Quiniæ sulph., ℈ ij.
M. ft. pil. xl.
Two pills three times daily, when patient is debilitated.

46. ℞. Hydrarg. iodid. vir., gr. v
Antim. et pot. tart., gr. j
Pulv. opii, gr. v.
M. ft. pil. xxx.
One pill four times daily, when patient is robust.

47. ℞. Hydrarg. chlor. cor., gr. ½
Tr. ferri chlor., ʒ ij
Liq. arsenici chlor., gtt. xxxvj
Acid hydrochlor. dil., ʒ j
Syr. sarsaparillæ co.,
Aquæ, āā f ℥ iij
M. Tablespoonful in water three times daily, to be given when the patient is debilitated.

48. ℞. Hydrargyri iodidi viri dil., gr. viii
Acidi arsenosi, gr. i
Blaud's mass, ʒ i
Pepsin, gr. xx.
M. ft. caps., no. xl.
Sig. 2 t. i. d. when debilitated. A most excellent combination.

SYPHILITIC ERUPTIONS.

49. ℞. For tubercular eruption five per cent. solution of the oleate of mercury well rubbed in.

---

50. ℞. Hydrarg. chlor. cor., gr. ii
Benzoin, ℥ ss
Cologne water, ℥ j
Rose water, ℥ ivss.
M. Use locally.

TERTIARY SYPHILIS.

51. ℞. Hydrarg. chlor. cor., gr. j
Potass. iodid , ʒ ij
Syr. ferri iodid., ʒ iv
Syr. sarsaparillæ co., } aaf ℥ iij.
Aquæ, }
M. Tablespoonful in water three times daily.

TONICS.

52. ℞. Acid arsen., gr. j
Strychniæ sulph., gr. $\frac{1}{3}$
Ferri sulph., ℈ j
Quiniæ sulph., ʒ j.
M. ft. pil. no. xx.
One pill three times daily.

---

53. ℞. Strychnia sulphate, gr. ss
Basham's mixture, f℥ vi.
M. Sig. fʒ ii. Ad in water after meals.

---

54. ℞. Tr. ferri chlor., } aa ℥ ss
Acid phos. dil., }
Syr. simp., ℥ iij.
M. A teaspoonful three times daily.

---

55. ℞. Ferri redact., } ℈ j
Quiniæ sulph., aa }
Ext. nucis vom., gr. x
Rhei pulv., ℈ j
Belladon. ext., gr. iij.
M. Div. in pil. xx.
S. One pill after each meal.

56. ℞. Ferri sulph., gr. ij
Magnes. sulph., ʒ j
Acid sulph. dil., ♏ x
Inf. quassii, ℥ j.
M. Tablespoonful in water three times daily.

COLD EVAPORATING LOTION.

57. ℞. Plumb. acet., ℥ j
Pulv. opii, ʒ j
Aquæ, Oj.
M. Use locally.

---

58. ℞. Liq. plumb. subacet., ℥ iv
Tr. opii, ʒ ij
Aquæ, Oj.
M. Use locally.

NITROUS POWDER.

59. ℞. Potass. nitrat., ʒ j
Antim. et pot. tart., gr. ss
Hydrarg. chlor. mit., gr. vj.
M. ft. pulv. vj.
One powder to be taken every two hours.

---

60. ℞. Pulv. opii, gr. iij
Pulv. ipecac, gr. vj
Hydrarg. chlor. mit., gr. iss
Potass. nitrat., ʒ ss.
M. ft. pulv. vj.
One powder to be taken every three or four hours.

SODA POWDER OF GUY'S HOSPITAL.

61. ℞. Sodii carb. exsiccat. ʒ j
Hydrarg. chlor. mit., gr. xij
Pulv. cretæ comp., ʒ ij.
M. Give from three to eight grains at night.

NEUTRAL MIXTURE.

62. ℞. Succi limonis, f℥ iss
Potass. carb., q. s. ad saturand,
Sacchari., ʒ ij
Antim. et pot. tart., gr. ss.
Aquæ destillat., f℥ iij.
M. A tablespoonful every two hours.

63. ℞.	Potass. citrat.,	ʒ iij
	Ol. lemon,	gtt. ij
	Sacchar.,	ʒ ij
	Aquæ destil.,	f℥ iv.

M. A tablespoonful every two hours.

EFFERVESCING DRAUGHT. ✓

64. ℞.	Potass. carb.,	ʒ ij
	Aquæ destil.,	fʒ iv

Solve.

℞.	Succi limon., Aquæ destil.,	aaf ℥ ij

M. Mix two tablespoonfuls of the lemonade with one of the alkaline solution, and let the mixture be drunk while effervescing. Repeat every two hours.

SPIRIT OF MINDERERUS. ✓

65. ℞.	Liq. ammon. acetat.	f℥vj
	Syr. limonis,	f℥ ij
	Vin. antim.,	fʒ iss
	Spir. æther. nitros.,	fʒ ij
	Tinct. opii,	gtt. xlv.

F. Mist. A tablespoonful every two hours.

JEFFERSON MEDICAL COLLEGE HOSPITAL FEVER MIXTURE. ✓

66. ℞.	Liq. potass. cit.,	℥ ss
	Spir. ether. nit.,	ʒ j
	Tr. aconit. rad.,	gtt. ij
	Morph. sulph.,	gr. $\frac{1}{8}$.

M. Give every third hour, in water.

SALINE MIXTURE, WITH ANTIMONY.

67. ℞.	Antim. et pot. tart.,	gr. $\frac{1}{18}$
	Tinct. aconit. rad.,	gtt. ij
	Spir. ether. nit.	ʒ j
	Magnes. sulph.,	℈ ij
	Syr. zingib., Aquæ,	āā ʒ ij.

M. Give every third or fourth hour in fever.

FOR DELIRIUM TREMENS. ✓

68. ℞.	Potass. brom., Sodii brom.	āā ʒ iij
	Chloral hydrat.,	ʒ ij
	Tinct. zingib.,	ʒ ij
	Tinct. capsici,	ʒ j
	Spt. ammon. aromat.	℥ iss
	Aquæ,	℥ iv.

M. Dose, a dessertspoonful in water.

LOCAL ANÆSTHETIC. ✓

69. ℞.	Chloroform.,	ʒ iiss
	Ether sulph.,	ʒ iv
	Menthol,	gr. xv.

M. Apply through an atomizer.

FOR NIGHT SWEATS. ✓

70. ℞.	Acid. camphoric,	ʒ iv
	Alcohol,	℥ ij
	Mucilag. acacia,	℥ iij
	Sp. aurant. corticis,	℥ vj.

M. A dessertspoonful an hour before the sweat is expected.

ITCHING HEMORRHOIDS.

71. ℞.	Pulv. gallæ,	gr. v
	Pulv. opii,	gr. x
	Cocainæ hydrochlor.	ʒ ss
	Ung. hydrarg.,	ʒ ij
	Cerat. simp.,	ʒ vj.

M. ft. ung.

Rub well in parts on going to bed.

ENEMATA.

72. ℞.	Ol. ricin.,	f℥ ij
	Syr. fusci,	f℥ ij
	Sodii chlor.,	ʒ j
	Infus. lini., tepid,	Oj.

Ft. enema.

One-half to be administered at once, and the remainder in half an hour, if no evacuation is produced.

73. ℞.	Saponis incisi,	℥ j
	Infus lini., tepid,	Oss.

M. Use as an enema in cases of flatulence and impacted fæces.

74. ℞. Ol. terebinth., f℥ ss
Vitellum unius ovi.,
Tere simul. et adde gradatim.
Decoct. hordei tep., f℥ x.
A stimulating injection.

75. ℞. Whiskey, f℥ ss
Hot coffee, f℥ ii
Hot normal salt solution q. s. ad, f℥ vi.
Sig. Inject. Used to react from shock after operation.

SUPPOSITORY FOR BLEEDING HEMORRHOIDS.

76. ℞. Ferri subsulph., gr. iij
Plumb. acet., gr. j
Mass. hydrarg., gr. ss
Ol. theobrom. q. s. ut ft. suppos. No. 1.
Introduce one morning and evening.

GOITRE.

77. ℞. Ung. hydrarg. ox. rub. ℥ ss.
Rub well on the tumor twice a day.

78. ℞. Ichthyol, ʒ ij
Adipis, ʒ vj.
M. Use locally.

FOR STRANGURY, TENESMUS, ETC.

79. ℞. Ext. belladon., gr. ss
Pulv. opii, gr. ij
Ol. theobrom. q. s. ut ft. suppos. No. 1.
S. Use morning and evening.

ALOPECIA.

80. ℞. Spir. ammon. aromat., f℥ j
Glycerinæ, f℥ ss
Tr. cantharid., fʒ j
Aquæ rosmarin., f℥ vij.
M. Apply to scalp morning and *evening.*

81. ℞. Tinct. cantharid., fʒ iss
Tr. capsici, gtt. xx
Glycerin., ʒ ss
Cologne water, ℥ j
M. Use on the scalp at night.

82. ℞. Ext. jaborandi, fld.,
Tr. canthar.,
Glycerin., } āā ℥ ss
Vaselin, ℥ iss.
M. Apply locally with a sponge morning and evening.

LINIMENTS.

83. ℞. Camphor., ℥ j
Ol. olivæ, f℥ iv
Ft. solution; tunc. adde,
Ol. terebin., f℥ iss.
M. To be applied by rubbing with a piece of flannel.

84. ℞. Ol. olivæ,
Aq. ammon., } āā f℥ j
Applied to neck in inflammation of the throat.

85. ℞. Tincture opii,
Spirit. camphor.
Tinct. canthar.,
Ether, } āā ℥ ss.
M. Make an embrocation.

86. ℞. Chloroform,
Ether,
Spirit. camphor,
Tinct. opii, } āāf ℥ j
Tinct. capsici, f℥ ss
An excellent embrocation.

87. ℞. Chloroform,
Tr. conii,
Tr. stramonii, } āā ʒ iij
Tr. aconit. rad., ʒ v
Saponis liniment, ℥ iss.
M. Use as embrocation.

APPLICATION TO ENLARGED GLANDS.

88. ℞. Ichthyol, ʒj
Ung. hydrarg., } āā ʒj
" belladon., }
" petrolei, ʒiv
Use locally night and morning.

ANTISEPTIC SOLUTIONS, ETC.

Bichloride of mercury solution in proportion of 1 to 1000.

89. ℞. Hydrarg. chlor. cor., ʒj
Alcohol, ℥j

A teaspoonful of this mixture to a pint of water is equivalent to one part of corrosive sublimate to a thousand parts of water.

One part corrosive sublimate to one thousand parts of water.

90. ℞. Hydrarg. chlor. cor., gr. x
Glycerinæ, ℥iss. j.
Aquæ destil., Gallon

Solution in which to place sponges, ligatures, etc., during an operation under the antiseptic method.

TO MAKE SUBLIMATE GAUZE.

91. Dissolve one part of corrosive sublimate and two parts of common salt in five hundred parts of water; soak the gauze in this for an hour, wring it out, and partially dry it in a clean room, *i. e.*, not in a hospital ward or sick room. Keep it in a moist condition in glass jars. The gauze generally in use is cheese-cloth, rendered absorbent by boiling in water, to which a slight amount of soda is added to remove its greasiness.

Gauze and drainage tubes should be kept in a solution of

92. ℞. Hydrarg. chlor. cor., gr. xxx
Sodii chlor., ℈vij
Glycerin., ʒiv.
Water, ½ gal.

TO CLEANSE THE VAGINA FOR A PLASTIC OPERATION.

93. ℞. Creolin, ʒj
Johnson's ethereal soap, Oj.
M. S. Use locally with a sponge.

PROFESSOR SENN'S DECALCIFIED BONE-CHIPS.

94. The tibia or femur of a freshly-killed ox is to be preferred, discarding the articular extremities; the shaft of the bone is to be sawed into segments two inches in length, which are to be placed in a fifteen per cent. solution of hydrochloric acid in distilled water, after removing the periosteum and marrow; this solution must be changed every twenty-four hours, until the segments are decalcified, which will be achieved in from two to four weeks.

The segments are then to be washed in distilled water, and afterward immersed in a dilute solution of caustic potash, to remove the excess of acid. When the acid is neutralized the segments are again immersed in distilled water for twenty-four hours, when they are taken out and the cancellous structure in the medullary canal removed. The segments are now cut into strips, in the direction of the long axis of the bone, of one half to three quarters of an inch in width. After this they are sliced into chips of one millimeter in thickness, which must be put in a glass-stoppered bottle containing a solution of bichloride of mercury in alcohol 1–500, and kept until required for use. During an operation the chips are to be placed in a five per cent. solution of carbolic acid.

TO PREPARE CATGUT FOR LIGATURES.

95. First immerse the catgut in ether for forty-eight hours; then place

it in a solution composed of twenty-five drops of sulphuric acid to one ounce of glycerine, for 45 minutes; from this solution it is removed and dried between bichloride towels and put in a mixture of equal parts of alcohol and Johnson's ethereal soap and allowed to stand 10 minutes; this neutralizes the acid; next put it for one hour in a solution composed of tartaric acid, one hundred grains; corrosive sublimate, twenty grains; and alcohol, five and a half ounces. Remove it and keep in alcohol until needed. During an operation it should be immersed in a solution of alcohol, one part, and bichloride of mercury solution (1–1000), four parts.

TO PREPARE CHROMIC ACID CATGUT.

96. ℞. Chromic acid, one grain.
Carbolic acid, two hundred grains.
Alcohol, two drachms.
Water, two ounces and six drachms.
Mix.

Place two hundred grains of catgut in ether for forty-eight hours; then immerse in the foregoing solution for two days; at the end of that time put it in tightly covered aseptic jars. When it is about to be used, put in a solution of alcohol, one part; bichloride solution (1–1000), four parts.

TO PREPARE SILKWORM GUT.

97. Immerse the gut in ether for forty-eight hours, then put it in a 1–1000 bichloride of mercury solution for an hour; remove it from this and keep it, until required for use, in tubes filled with absolute alcohol; or *it may be boiled* for 20 minutes.

DEODORIZED IODOFORM.

98. ℞. Iodoform, ℥j
Menthol, gr. xxiv
Ol. lavend., gtt. xxxij.
M.

99. ℞. *Caff. iodoform, gr. xcvj
Ung. petrolii, ℥j.
M. Use locally.

*Caff. Iodoform is composed of equal parts of iodoform and coffee; the latter ingredient is used to disguise the smell of the iodoform.

ETHEREAL SOLUTION OF IODOFORM.

100. ℞. Iodoform, gr. xv
Ether, ℥j.
M. To be used on chromic ulcers, abscesses, etc.

EMULSION OF IODOFORM.

101. ℞. Iodoform, ʒx
Glycerin., ʒc.
M. Not over five drachms of this mixture to be used locally at one time; and in chronic abscess for each ounce of pus, four and a half grains of iodoform and forty-eight drops of glycerine are allowed to be used at any one time.

IODOFORM COLLODION.

102. ℞. Iodoform, gr. xlviij
Collodion, ℥j.
Use locally.

BICHLORIDE OINTMENT.

103. ℞. Hydrarg. chlor. cor., gr. j
Ung. petrolii, ℥j.
M. Use locally.

KOUMISS.

104. ℞. White sugar, 2 tablespoonfuls.
Compressed yeast, half cake.
Fresh milk, one quart.

Mix and place in an apartment ranging in temperature from 70° F. to 95° F. for six hours, turning the bottle once during the first hour. Let it remain in a refrigerator for twelve hours.

If, when the bottle is opened, the fluid is found to be sweet, the indication is that the fermentation has not been carried sufficiently far; if it is found thick and curdled the process of fermentation has been too much prolonged. These conditions must be controlled by the length of time the fluid is kept in a warm room, or by the quantity of yeast used.

INDEX

PAGE
ABDOMINAL SECTION ... 125
—— —— surgery ... 125
Abscess ... 19
—— symptoms ... 19
—— treatment ... 21
—— brain ... 82
—— lumbar ... 198
—— psoas ... 198
Air passages, foreign bodies in. 265
Amputations ... 200
—— considerations, general ... 200
—— methods, circular ... 202
—— ——flap ... 203
—— —— Chopart's through medio-tarsal articulation ... 216
Amputation, of arm ... 219
—— of fingers ... 223–228
—— of forearm ... 221
—— of foot ... 215
—— of leg ... 210
—— of thigh ... 208
—— operation of Chopart ... 216
—— —— of Hey ... 216
—— —— of Lisfranc ... 215
—— —— of Pirogoff ... 210
—— —— of Senn ... 206
—— —— of Symes ... 213
—— —— of Teale ... 220
Anastomosis, intestinal ... 131
Aneurism ... 122
—— symptoms ... 123
—— treatment ... 123
—— varieties ... 122
Ani prolapsus ... 276
Ankle joint, excision of ... 231
Ankylosis ... 195
Anthrax ... 282
Antiseptic surgery ... 30
Anus, fissure of ... 277
Appendicitis ... 127
Arteries, ligation of ... 235
Asepsis ... 30

BACTERIOLOGY ... 22
—— —— aerobiosis ... 23
—— alexins ... 29
—— antitoxins ... 29
—— classification ... 22
—— cultivation ... 26
—— definition ... 22
—— habitat ... 26
—— immunity ... 29
—— infection ... 28

PAGE
Bacteriology, intoxication ... 28
—— Koch's circuit ... 27
—— leucomains ... 29
—— pathogenicity ... 27
—— products ... 28
—— ptomains ... 29
Bandages, arm, figure-of-8 ... 288
—— bis-axillary, cravat ... 308
—— —— scapulary ... 309
—— breast, suspensory, both.. 298
—— —— —— one ... 297
—— chest, anterior ... 295
—— —— posterior ... 296
—— crossed, angle of the jaw. 293
—— Desault's ... 311
—— elbow, figure-of-8 ... 304
—— Esmarch's ... 310
—— eye, one ... 291
—— eyes, both ... 292
—— finger, one ... 301
—— fingers, all ... 301
—— Fox's ... 313
—— gauntlet ... 301
—— glue ... 319
—— groin, double ... 300
—— —— one ... 299
—— handkerchief system ... 306
—— head ... 289
—— —— knotted bandage ... 292
—— instep ... 306
—— jaw, Barton's ... 295
—— —— Gibson's ... 294
—— knee ... 305
—— lower extremity ... 305
—— paraffin ... 318
—— perineum, and pubes ... 301
—— plaster-of-Paris ... 318
—— recurrent, of stump ... 314
—— Sayre's, clavicle ... 313
—— —— jury mast ... 318
—— —— plaster jacket ... 314
—— Scultetus ... 310
—— shoulder ... 299
—— silicate of potassium ... 318
—— —— of sodium ... 318
—— square cap ... 307
—— starch ... 319
—— thumb, spica ... 302
—— upper extremity, spiral.... 304
—— Velpeau's ... 311
Brain, abscess of ... 82
—— compression ... 77
—— differential diagnosis ... 78
—— treatment ... 78

PAGE
Brain, concussion of 76
—— —— symptoms and treatment 76
—— topography of 74
Bladder, tapping the 98
Boil 283
—— treatment 283
Bubo, chancroidal 101
—— symptoms 102
—— syphilitic 104
—— treatment 102
Burns and scalds 61
—— symptoms 61
—— treatment 62

CALCULI, RENAL 133
Carbuncle 282
—— treatment 282
Carcinoma of rectum 278
—— treatment 278
—— of testicle 274
Caries 196
—— treatment 196
Castration 274
Chancre 104
—— symptoms 104
—— treatment 105
—— varieties of 104
Chancroid 99
—— symptoms 99
—— treatment 99
Chancroidal bubo 101
Chest pressure, in drowning... 286
Chilblain—frostbite 67
—— symptoms 68
—— treatment 68
Club foot 279
—— treatment 280, 281
Collapse and shock 70
—— symptoms 71
—— treatment 71
Colotomy 130
Compound fractures 190
Compression of the brain...... 77
—— differential diagnosis 78
—— symptoms 76
—— treatment 77
Concussion of the brain 76
—— symptoms 76
—— treatment 76
Coxitis 194
—— treatment 195
Cranio-cerebral topography ... 74
Cystitis 88
—— symptoms 88
——treatment 88

DISEASES OF THE SPINE. 198
—— —— angular curvature. 200
—— —— lateral curvature ... 199
—— —— psoas abscess 198
Disarticulation of ankle joint. 213
—— of elbow joint 220
—— of fingers 223
—— *of hip joint* 204

PAGE
Disarticulation of knee joint... 210
—— of shoulder joint 217
Dislocations, definition of 145
—— ankle joint 162
—— clavicle 149
—— compound 147
—— elbow 153
—— fingers 154
—— hip joint 156
—— humerus 150
—— knee 160
—— lower jaw 148
—— patella 160
—— thumb 155
—— toes 154
—— wrist 154
Drowning 285

EAR, AFFECTIONS OF.... 266
—— accumulation of wax in. 266
—— follicular abscess 267
Eczema of auricle 267
Elbow-joint, excision of 226
Epididymitis 86
Epistaxis 264
Erysipelas 68
—— symptoms 68
—— treatment 69
—— varieties 70
Excision of joints 225

FARADIZATION 287
Fever, surgical, classification 8
Felon 284
Fissures of anus 277
Fistula in ano 276
—— treatment 276
Foreign bodies in air passages.. 263
Formulæ 310
Fractures, general treatment... 163
—— of the acetabulum 178
—— of the carpus 178
—— of the clavicle 169
—— compound treatment of .. 190
—— general considerations 165
—— epiphyseal 164
—— of the femur in children.. 185
—— of the fibula 189
—— of the forearm 176
—— of the foot 190
—— of the humerus 172
—— of the upper jaw 167
—— of the lower jaw 168
—— of the leg 188
—— of the nose 168
—— of the os calcis 190
—— of the patella 186
—— of the pelvis 178
—— Pott's 189
—— of the radius shaft 176
—— of the neck of radius.... 176
—— repair of 165
—— of the ribs 171
—— of the scapula 171

K007

PAGE

Fractures, signs of 164
—— of the skull 78
—— of the sternum 170
—— of the thigh 180
—— of the ulna 176
—— ununited 166
—— of the zygomatic arch 167
Frostbite 67-68
Furuncle 283

GONORRHŒA 83
—— symptoms 84
treatment 85
Granulations, varieties 66

HÆMATOCELE 272
treatment 273
Harelip 262
Head, injuries of 73
Hemorrhage 36
—— from urethra 98
—— intracranial 82
—— recurrent 38
—— secondary 38
Hemorrhoids 274
—— external 274
—— internal 274
Hernia 135
—— symptoms 136
—— treatment 138
—— varieties 135
—— oblique inguinal, radical cure for 143
—— Mayo's operation umbilical 142
Hip-joint disease 194
—— excision of 228
Housemaid's knee 284
Hydrocele 270
—— radical cure of 271
Hydrophobia 59
—— symptoms 59
—— treatment 60
—— Pasteur's method of treatment 60

INFLAMMATION 1
—— etiology 5
—— symptoms 5
Inflammation, terminations 2
—— treatment 12
—— varieties 2
Ingrowing toe-nail 281
Injuries of the head 73
Intestinal anastomosis 131
Intubation of the larynx 258

JOINTS, EXCISION OF 225

KNEE-JOINT, EXCISION of 229
Kocher's method of treating fractured patella 188

PAGE

LAPAROTOMY 126
Laryngotomy 265
Larynx, intubation of 266
Lateral curvature of spine 199
Ligation of the anterior tibial artery 254
—— of arteries, general considerations 233
—— axillary 242
—— brachial 243
—— common carotid 238
—— external carotid 240
—— —— iliac 247
—— facial 235
—— femoral 250
—— innominate 241
—— lingual 237
—— occipital 235
—— peroneal 255
—— popliteal 251
—— posterior tibial 252
—— radial 245
—— sciatic 249
—— subclavian 241
—— ulnar 246
Ligatures 46
Lithotomy 259
Lithotrity 259
Lumbar abscess 198

MICROCEPHALUS 83

NASAL PASSAGES, AFFECTIONS of 263
—— epistaxis 264
—— foreign bodies in 263-265
Neck, triangles of 235
Necrosi 196
Neoplasm 113
Nephrorrhaphy 134
Nephrotomy 135
Nephrectomy 135
Nephroptosis 133

ORCHITIS 85
—— chronic 86

PARAPHIMOSIS 267
Pasteur's treatment of hydrophobia 60
Patella, Kochner's method of treating fractures 188
Pernio 67-68
Phagedenic ulcers 64
Phimosis 267
Pott's disease of spine 200
Prolapsus ani 276
Prostatitis, acute 87
Psoas abscess 198
Pyæmia 11
—— prognosis 12
—— treatment 12

PAGE

QUESTION OF AMPUTAtion in wounds 59

RACHITIS 197
Rectum, carcinoma of ... 278
Renal calculi 135
Retention of urine 95

SARCOCELE (CHRONIC ORchitis) 85
Scalds and burns 61
—— symptoms 61
—— treatment 62
Secondary syphilis 105
Septicæmia 9
—— treatment 11–12
Shoulder joint, excision of.... 226
Shock or collapse 70
—— treatment 71
Skin grafting 66
Skull, fractures of 78
Spine, diseases of 198
—— angular curvature of...... 200
—— lateral curvature of 199
—— treatment 199–200
Sprains 192
Stone in bladder 258
—— treatment 259
Stricture 89
—— treatment 90
Suppuration 18
—— symptoms 19
—— treatment 19
Suprapubic cystotomy 261
Surgery, antiseptic 30
Surgical bacteriology 22
—— fever 8
Sutures 40
Synovitis 193
Syphilitic bubo 101
Syphilis 103
—— secondary 105
—— —— treatment 107
—— tertiary 110
—— —— treatment 111

TAPPING THE BLADDER.. 98
Tertiary syphilis 110
Testicle, orchidectomy 274
—— carcinoma of 274
Tetanus 71
—— treatment 72
Toe nail, ingrowing 281
Tracheotomy 265
Traumatic fever 8
Trephining 80
Triangles of the neck 235
Tumors 113
—— adenoma 119
—— adrenal 119
—— angeioma 117
—— carcinoma 120
—— causes of growth 113

PAGE

Tumors, chondroma 116
—— cysts 121
—— definition of 113
—— endothelioma 119
—— epithelial type 120
—— fibroma 114
—— glioma 117
—— lipoma 114
—— lymphangioma 118
—— myoma 117
—— myxoma 117
—— neuroma 117
—— odontoma 118
—— osteoma 116
—— papilloma 119
—— sarcoma 119
—— teratomata 121
—— theory of Cohnheim 113
—— —— of parasitic 114
—— treatment of 119

ULCERS, ACUTE 63
—— symptoms 64
—— treatment 64
—— chronic 65
—— —— symptoms 65
—— —— treatment 65
—— phagedenic 64
Urethra, hemorrhage from 98
—— treatment 98
Urethrotomy, dilating internal.. 93
—— —— external perineal.... 94
—— —— continuous 92
—— —— gradual 92
—— —— modified rapid 92
—— —— perineal section, Cock's operation .. 94
Urinary calculi 256
—— treatment 257
Urine, retention of 95
—— —— symptoms 95
—— treatment 96–97

VARICOCELE 273
Varicose veins 278

WHITEHEAD'S OPERAtion 275
Whitlow 284
Wounds 44
—— contused, open 51
—— —— subcutaneous 51
—— dissection 56
—— gunshot 54
—— incised 48
—— lacerated 50
—— of arteries 44
—— of chest 58
—— of joints 58
—— of throat 57
—— punctured 53
—— question of amputation in. 59
Wrist joint, excision of....... 227

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